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WEST COAST OFFICE

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Telephone 714-830-0881

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Western Editor
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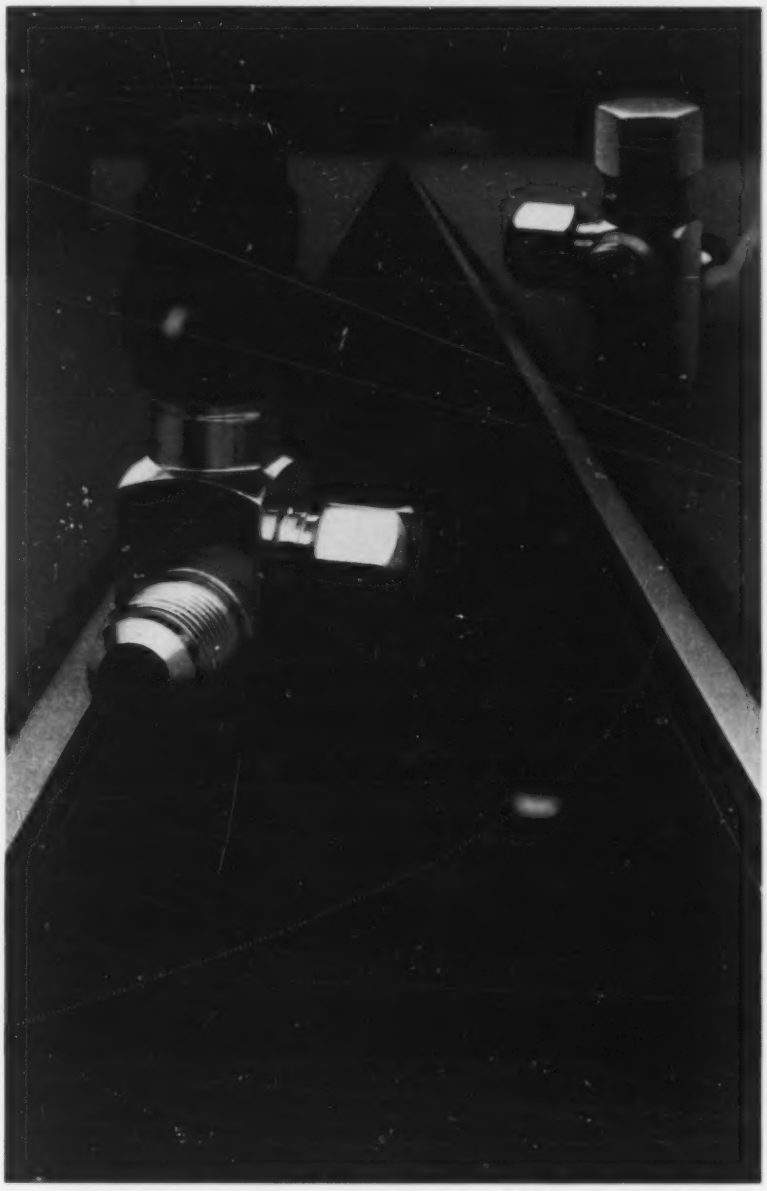

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THE NEWS

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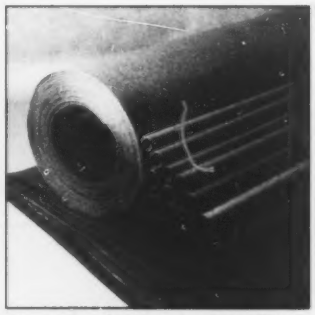

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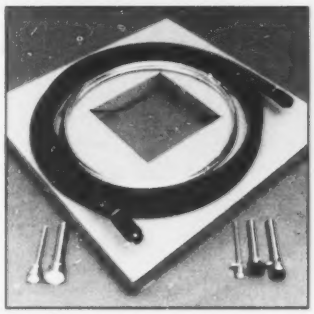

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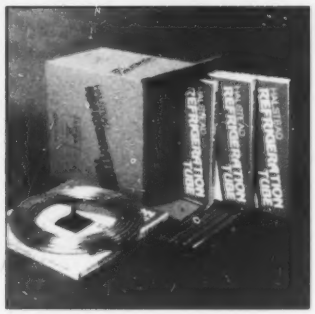

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FORECASTS

by Gordon D. Duffy and Thomas A. Mahoney

AIR CONDITIONING

Strength in both new housing starts and replacements carried unitary air conditioner shipments to record heights in 1986. An anticipated 11% decline in housing starts this year, almost all in the multifamily rental sector, will hit heat pumps hardest. Replacements should make up the difference and hold unitary shipments even at 3.5 million.

HEAT PUMPS

Heat pump shipments in 1986 set a new record for the third year in a row. That 884,203-unit total could well be the high-water mark for heat pumps this decade. A 25% drop in multifamily housing starts, a poor outlook for housing in the South, and some minor market share losses in the North spell a 7% decline this year to 820,000 units.

FURNACES

The market for gas, oil, and electric residential furnaces also set a new record in 1986 at 2,687,935 units, thanks to a record performance from gas furnaces and a strong showing by oil units. A flattening of the replacement market for reasons of efficiency and the decline in housing starts should be offset by a modest increase in replacements for another 2.7 million-unit year in 1987.

BOILERS

The continued strength of the new home market in the Northeast, heartland of the hydronics industry, means another good year for gas- and oil-fired boilers. We expect boilers to hold the market penetration gains of the last two years and, with relatively modest interest rates, make some replacement gains. Look for a 2% increase to 340,000 units.

CHILLERS

Chiller shipments held their own last year but it probably was the lull before the storm. The sharp decline in office building construction will make itself felt in 1987 and we doubt that exports, which are showing signs of growth, will recover enough to make up the difference. We expect a decline of 10%. It could be more.

ROOM AIR CONDITIONING

Competition at home from central systems and from imports, and competition abroad from Japan and Brazil, have combined to produce rough times for room air conditioners. Even so, the declining value of the dollar against the Japanese yen should halt this product's slide. We're predicting a flat year in 1987 but a hot summer could mean a substantial increase in impulse purchases.

COMMERCIAL REFRIGERATION

Even though the construction of community and neighborhood shopping malls will be down slightly this year, the remodelling of existing supermarkets and the trend toward more energy-efficient fixtures should produce a modest increase in this market. An increase of 2.5% should be about right.

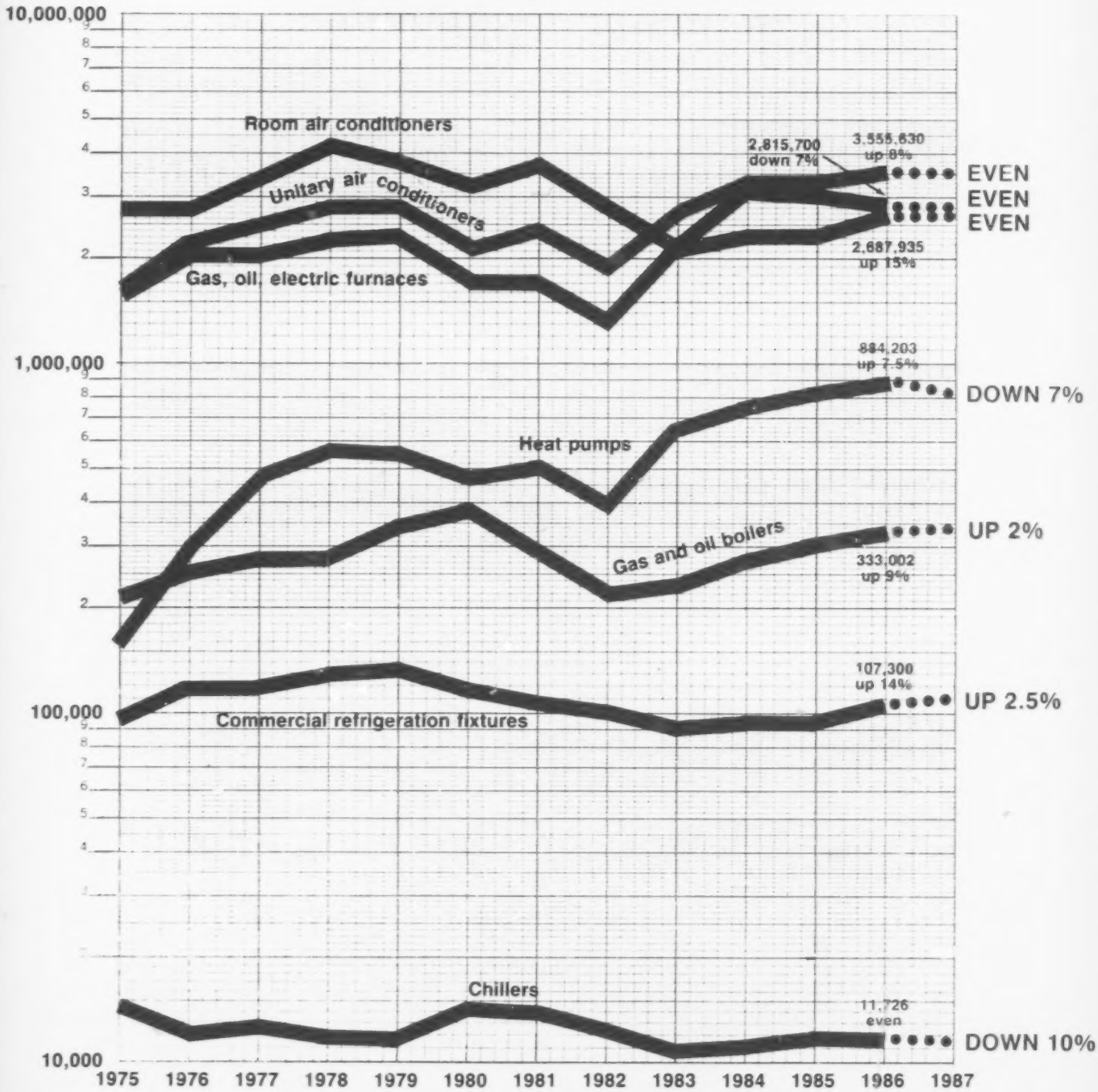
HOUSING

The regional characteristics of the last two years — strong in the Northeast and Midwest, weak in the South — will be with us again in 1987. Single-family home building should hold within 4% of last year's level but multifamily starts, hampered by the overbuilt rental market, will drop by 25%. The total for 1987 is forecast at 1,610,000 units, down 11% but still respectable.

REPLACEMENTS

Affordable interest rates should help replacements, which vary widely among product groups. They ranged from less than one in 10 electric furnaces to nine of 10 oil furnaces shipped. One of every two central residential cooling units now is a replacement, but it's only one of five for heat pumps. Replacements for reasons of efficiency have levelled off but that market already was substantial.

Industry trends



1987 IN PERSPECTIVE

It's difficult to talk of caution after a year in which shipments of residential heating and cooling equipment were at or near all-time highs. Light commercial markets were strong and even field-engineered system components faltered only a little.

In 1987, though, we will not be quite so fortunate.

Against the backdrop of a lackluster general economy, markets for the products produced by the industries served by The News mostly will be down this year. And, like the economy as a whole, the picture will be uneven.

First the good news. The residential comfort heating and cooling markets should continue at last year's record pace despite a drop in housing starts. The growing replacement market should pick up the slack.

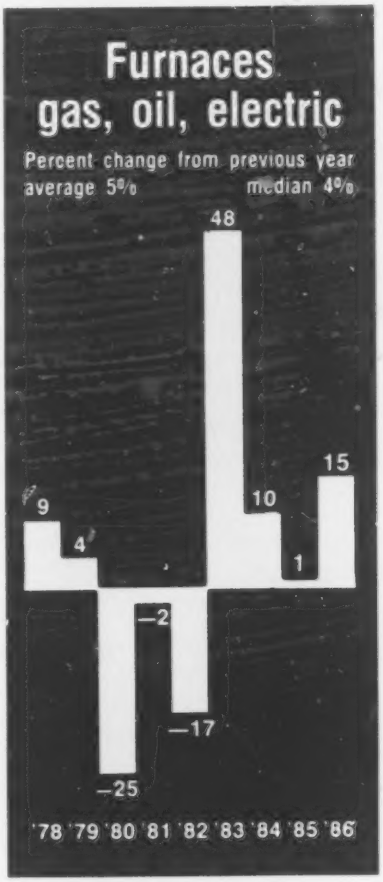
There will, however, be a modest decline in the heat pump market. It will be affected by a 25% decline in multifamily housing starts, little growth in its main market, and some fuel shifts in the North.

Light commercial construction, although down a bit, will continue strong by historical standards. But the market for field-engineered system components, bolstered last year by deliveries to a grossly overbuilt office building market, will suffer most.

Early in 1987 the industry ended a decade of uncertainty and apprehension with the passage of mandatory federal energy efficiency standards for residential heating and cooling equipment effective in the period 1990 through 1993. It was a major victory for a coalition of industry, environmental, and consumer interests. The law promises to clear away a collection of differing state standards and, for the first time since 1976, allow the industry to plan for orderly marketing.

For the economy as a whole, we can expect another in a now five-year progression of slow-growth years. If there's any consolation, it's that the next recession continues to remain over the horizon.

Because of weaknesses in so many other areas of construction, the building of new homes continues to play an important role. New private home starts, which totaled 1,806,600 units in 1986, improved by 3.7% over the previous year's performance.



Housing construction, it would appear, reached its 1980's peak in early 1986. Even though the single-family home and condominium segments of the market promise to remain relatively strong for the forseeable future, they will not be strong enough to compensate for a sharp decline in the rental apartment market that's likely to be with us for the rest of the decade.

Rental apartment construction was stimulated during the mid-1980's by real estate depreciation and by tax shelter-oriented syndicates with an obligation to build regardless of demand. Tax law changes and a much lower property appreciation rate removed these stimulants in 1987, but not before that market was left with a vacancy rate of 7.5%, the highest in 20 years. Over the next four or five years the rental apartment market must absorb 500,000 vacant units.

The single-family and condominium segments of the market should continue to do well on a national basis, although not quite as well as last year. Growth will be limited and strength will be a highly regional affair.

Markets continue strong in the Northeast, Middle Atlantic states, and the non-agricultural sectors of the Midwest. Florida is the only bright spot in the South and California continues to do well in the West. The densely populated Northeast, despite strong demand, already is being limited by land assembly problems.

Summing up, we expect single-family starts will total 1,135,000 units in 1987, down only 3.8% from last year. But multifamily starts will drop by 25% to 475,000 units. That makes a total for 1987 of 1,610,000 units, down 11%. Just as importantly, we don't expect new home starts to climb back to

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FROM PAGE 10

the 1.8 million mark until the early 1990's.

Light commercial construction, like housing, has been a bulwark of today's construction market. The construction of stores, restaurants, shopping centers, and the like soared to 300 million sq ft in 1985. The decline last year from this near-record level was only about 4%, to 575 million sq ft.

A forecast additional decline of 7% in 1987, to 535 million sq ft, by the F.W. Dodge Division of McGraw-Hill Information Systems Co., still leaves a strong cushion over this market's cycle bottom of about 300 million sq ft. What's more, this market can be expected to pick up steam again late in the year.

Helped by favorable demographics, institutional construction should almost hold the line at 315 million sq ft this year, down just a hair from 1986 experience. This market, which should grow slowly for the next several years, benefits from demographics at both ends of the spectrum.

After years of declining demand, the nation is again building new schools for the children of the baby boomers. And, as the general population ages, there is a growing demand for new hospitals and other health care facilities. Municipal bonds continue to be tax free under the new tax legislation, but the squeeze on grants-in-aid to state and local governments doesn't allow for much expansion of government building.

Industrial construction, which declined from an average of 300 million sq ft in the 1960's to 200 million sq ft by the end of the 1970's, has hovered at about 140 million sq ft for the past two years. Only marginal improvement is expected this year.

The major problem in this market, of course, is the effect of foreign competition at home and abroad. Even though the dollar has declined in value against the German mark and the Japanese yen, the trade balance has not improved. And the relationship between the U.S. dollar and that of Canada, its biggest foreign customer, has changed little.

Until increases in the price of imported goods create a significant increase in U.S. product demand, it's unlikely that industrial construction will improve. Another signal for increases in this market is when production utilization crosses 80%. Last year it averaged only about 78%. And the cost of borrowed money, acceptable to many other markets, still is too high for industries locked in a competitive struggle.

The commercial office building market, of vital importance to a large segment of the hvac industry, is in trouble. After a 22% decline last year, an additional drop of the same magnitude is forecast for 1987. Many feel that the decrease to 210 million sq ft this year (from 265 million sq ft in 1986) still will not take this market to the bottom of the cycle.

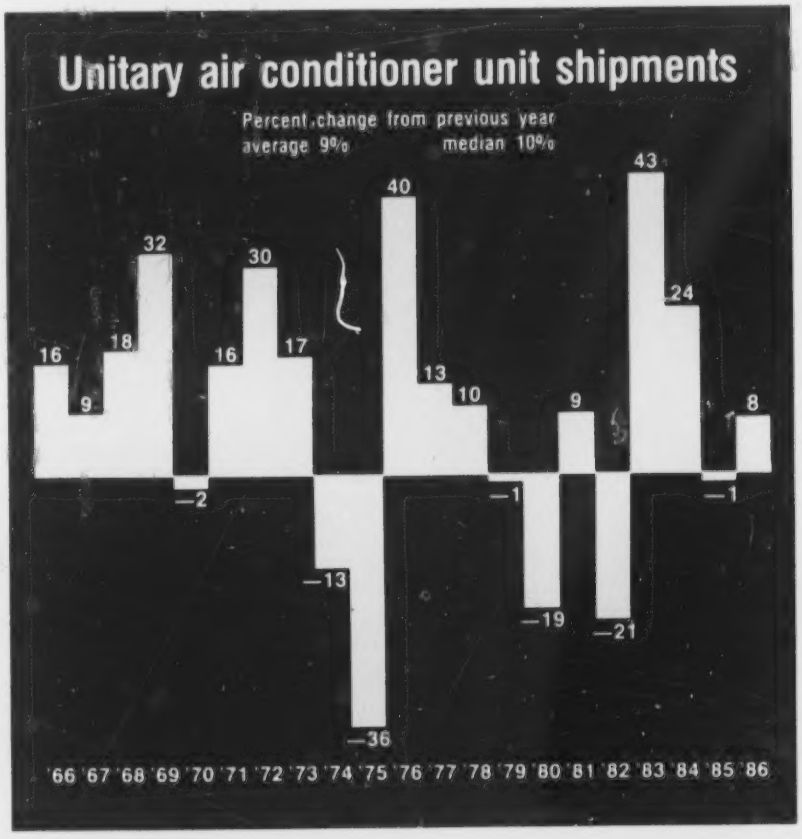
The reason is simple. In the years 1981 through 1985, office building construction averaged 300 million sq ft when there was a demand for only about 250 million sq ft. The result has been vacancy rates in the 10% to 20% range for many cities (see this issue's special section on office buildings starting on page 39). In fact, it will probably take four to five years to work off the surplus 200 million sq ft of vacant office space.

The primary reason for the surplus disappeared with the Economic Recovery Tax Act of 1986. Depreciation was extended from 19 to 31.5 years and investors no longer can use "passive" losses on real estate to shelter other income. Here again the tax shelter-oriented syndicates retired from the scene, but not before they had left a legacy of far too many speculative buildings.

Too, the steep decline in oil prices in late 1985 left many projects, particularly in cities like Houston, stranded as the boom oil economies turned to bust almost overnight. Office building construction will continue, especially in the Northeast and Middle Atlantic states, because job creation and economic expansion most often is where vacancy rates are the lowest.

Helped by strong new home, replacement, and light commercial markets, unitary air conditioner shipments totaled a record 3,555,630 units last year. Likewise, heat pump shipments totaled 884,203 units and set a new record for the third year in a row.

The 8.1% increase for unitary air conditioning, which included a 7.5% gain for heat pumps, provided a heady market that will be hard to top this year. In fact, we feel an even year at 3.5 million units is just about right for



1987 given the forecast drop in housing starts and heat pump shipments.

Yes, we said heat pumps. Despite the strong showing of heat pumps over the past three years, we feel they reached a high-water mark for the decade in 1986 and, this year, will decline by 7% to 820,000 units. In terms of total unitary shipments, however, we feel the expected increase in replacement air conditioners will make up for the loss.

Heat pumps will take it on the chin in two major areas. The decline of multifamily rental construction in the South, which has been propped up for two years by tax shelter-oriented syndicates, will impact directly on air-to-air heat pumps. And although heat pumps dropped only two points nationally (to 29%) in new single-family home penetration, the decline was much steeper in the active Northeast and Midwest markets where oil- and gas-fired systems gained.

Even though the 1986 year-end inventory was a below-average 26.7% of unitary shipments as a whole, the mix promises to be somewhat different because of more replacements this year. In the case of heat pumps, however, year-end inventories, at 33.2% of shipments, were approaching the upper limits which lead to unusually severe competitive pricing.

The biggest disappointment in the comfort cooling market involved room air conditioners. Shipments of room units declined by 6.8% last year to a total of 2,815,700 units. They were victims of a moderate summer in most parts of the U.S., a 45% increase in imports, and an export market that has evaporated from 25% of shipments to 2% in less than a decade.

Total gas, oil, and electric furnace shipments in 1986, at 2,687,935 units, broke a record that had stood since 1972. And while we don't expect another record year in 1987, we don't think total furnace shipments will sag by more than 5%, thanks to both replacements and increased market penetration.

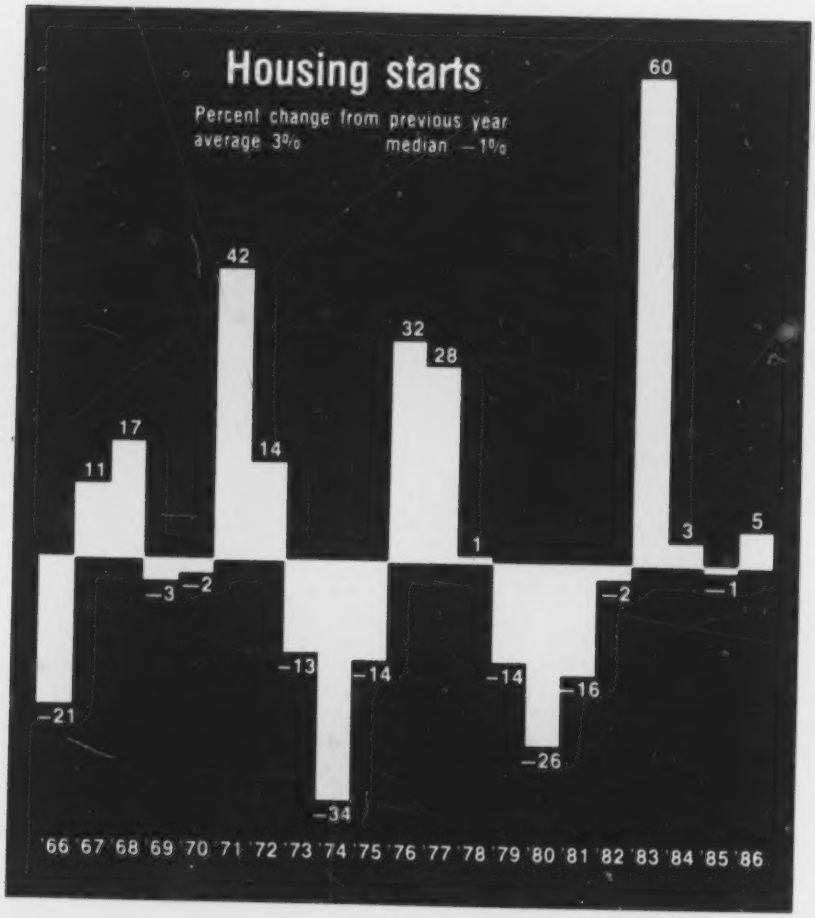
Of the three, it was the gas furnace that set a new record of its own. The 2,104,805 gas furnaces shipped last year represented a 15.5% increase over 1985 and broke 1979's record of 1.86 million units by a wide margin.

Oil furnace shipments increased by 36.2% to 200,540 units last year, thanks in large measure to the strong Northeast new home market, but it was not a record. Electric furnaces increased last year by 4.5% to 382,590 units. Looking ahead, we think gas furnaces this year will hold even, oil furnaces will gain 2%, and electric furnaces will decline by about 5%.

Shipments of gas- and oil-fired residential boilers last year increased by 9.1%, to a total of 333,002 units. The increase, which followed a 10.1% gain in 1985, was almost wholly due to an increase in the penetration of hydronic systems in the Northeast new home market.

In the realm of field-erected systems, the chiller market held virtually even last year. The decline, because of the problems in the office building market, is expected to make itself felt in 1987 and beyond. The depressed domestic market may, in future, be helped by a more competitive position in world markets.

The commercial boiler market, in the doldrums for many years because of energy conservation and a flat plant construction market, is expected to hold even in 1987 at last year's 22.5 million pounds of steam per hour. The cogeneration market, which increased by 157% to 1,067 megawatts last year, is expected to drop back to half that total in 1987.



Efficiencies

With the passage by Congress of the National Appliance Energy Conservation Act, it would appear that a decade of apprehension, debate, and turmoil over a broad range of residential heating-cooling equipment and major home appliances has come to an end.

The matter came to a head a year ago. Even though the Department of Energy (DOE) had decided federally mandated minimum standards could not be justified economically, many states enacted their own standards. Not only did these standards vary, but it appeared that the leaders were vying with one another to become the state with the strictest standard.

Two major developments precipitated a change of heart among the majority of those in industry. The Natural Resources Defense Council won a

lawsuit requiring DOE to put aside its no-standard standard and rethink the issue. And it also became clear that DOE was not about to use its power to force the states into accepting that standard.

The result was a long series of tough negotiating sessions that included all of the industry groups affected, environmental and consumer groups, and state representatives. They produced a compromise that was translated into legislation and quickly pushed through the 99th Congress in its final days. When President Reagan refused to sign the bill, however, it was pocket vetoed.

Early in 1987, however, virtually the same bill was again passed by Congress and became law. It sets federal mandatory efficiency levels that become effective in the period 1990 through 1992. Future upgrades of those minimums will be at the discretion of the Secretary of Energy. DOE has yet to set a minimum for gas furnaces of less than 45,000 Btuh capacity, but Congress mandated it must be between 71% and 78% AFUE (annual fuel utilization efficiency).

The legislation represents a major victory for the industry groups who participated. It will bring long-awaited order to a fractionated marketplace. All of the minimums have been attained by most manufacturers with equipment now offered. In fact, market forces already have brought average efficiencies a considerable distance along that road.

For example, in 1992, split-system air conditioners and heat pumps must have a minimum SEER (seasonal energy efficiency ratio) of 10. A year later, single-package units must have an SEER of 9.7. In 1986, the sales-weighted average of all residential units 65,000 Btuh and under was 8.868. The average for split-system cooling units was 8.867, and for single packages it was 8.874. For heat pumps in the same size range, the 1986 average was 8.7 SEER, up from 8.56 SEER a year earlier.

In the case of room air conditioners, which must meet an energy efficiency ratio (EER) of from 8 to 8.6 in 1990, efficiencies also are improving. In 1985, units with EER's of 8.5 or more captured 39.2% of the market, up from 11.4% five years earlier. Units with EER's of less than 6.5, which accounted for more than half the market a decade earlier, had only an 18.4% share in 1985.

Nearly a third (30.9%) of gas furnaces shipped in 1986 could meet the federal standard of 78 AFUE effective in 1992. And while this proportion has remained essentially the same for three years, the proportion of those furnaces with the highest efficiencies (86% AFUE or more) has grown steadily. More than half of oil furnaces (52.4%) shipped last year had AFUE's of 80% or better, up from 24.2% only two years earlier.

These figures demonstrate that natural market forces do work and that equipment is available today from virtually every manufacturer that can meet the new federal minimum standards. And now that the targets are in place, it's a fair expectation that average efficiencies will climb rapidly as the industry emphasizes to home builders and homeowners what equipment the home of the 1990's should have.

Replacements

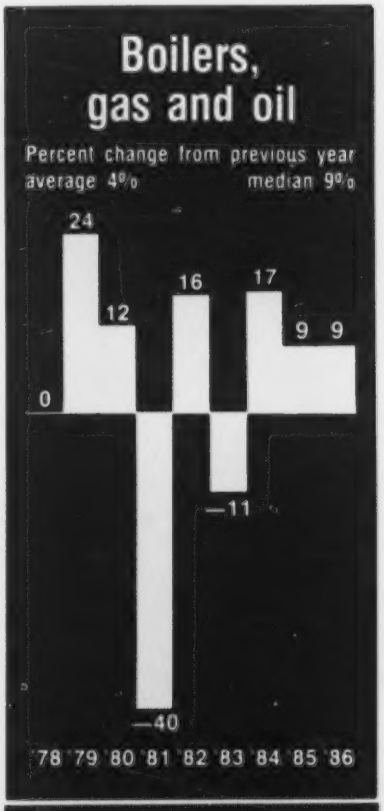
The replacement market is the best single antidote to the boom-and-bust characteristics of new construction. When residential heating and cooling equipment shipments were at or near all-time highs, as in 1986, replacements tended to take a back seat to the more volatile new construction market. But when new construction declines sharply, as in the commercial office building market, replacements take on a much more important role.

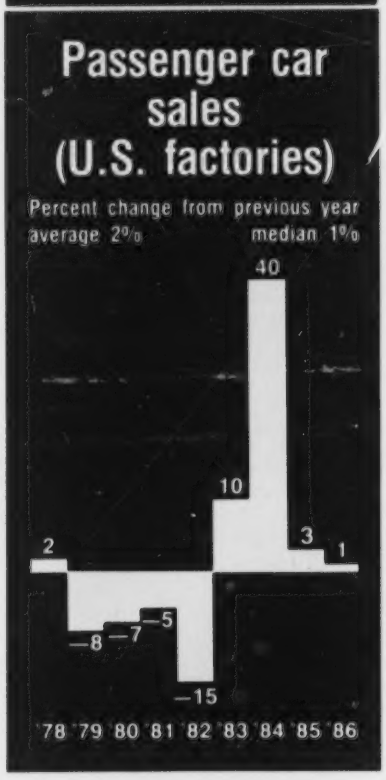
Except for the comparatively young electric furnace and heat pump markets, home heating equipment replacements are well established. Three out of four residential boilers last year were replacements only because of an increase in the hydronic share of new homes. Usually it's eight of 10.

Nine of 10 residential oil furnaces are replacements, a market that's amply supplemented by 214,000 replacement oil burners. In the case of gas furnaces, which have a substantial share of the new home market, we estimate that six of 10 were replacements.

It would be misleading to develop a single number for residential unitary air conditioners because of the disparity between comfort cooling and heat pumps. The much older comfort cooling market is maturing rapidly. We estimate that half (50.5%) of the residential units shipped last year were replacements.

Not so with heat pumps and electric furnaces. We estimate that only 22.6% of the residential heat pumps shipped





last year were replacements. Only one in 10 electric furnaces were replacements.

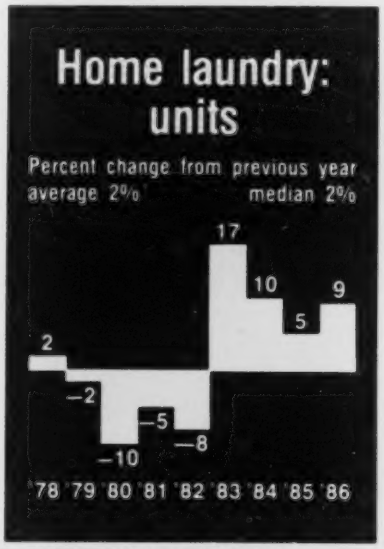
It should be noted that, in addition to those units replaced because they are worn out or suffered a major breakdown, another sizeable market has developed over the past four years. Contractors and manufacturers have discovered that more than a few homeowners are replacing old equipment in good working order for reasons of efficiency.

The movement was given impetus by the rapid escalation of fuel prices but, in the year or so since the price of fuel has started to decline, there has been no indication that this market is shrinking. It would appear that many feel that today's respite is temporary.

The commercial replacement market is much more difficult to judge. We estimate that about 35% of commercial rooftops (10% for heat pumps) are replacements and that about the same proportion of field-erected system components go into the replacement market.

The precipitous drop in the world price of oil from $28/barrel late in 1985 to $10.91/barrel in mid-1986 was a two-edged sword.

It curbed any widespread price increases among natural gas and electric competitors. The lower prices saved money at the gasoline pump that was added to discretionary income. It helped keep inflation low and helped fuel oil regain some share of market. And it devastated the domestic oil and gas exploration industry and the economies of Texas, Oklahoma, Louisiana, and Alaska — oil-producing states. Imported oil increased by 18% last year, half of it from OPEC nations.



Early in 1987, the Organization of Petroleum Exporting Nations (OPEC) established a floor price of $18/barrel for their oil after many agreement failures. As we go to press, this shaky alliance was holding but, with the heating season over, we expect that the cartel will again fall apart. Look for oil prices this year in the $16 to $17 range, or even a bit lower.

The effect of these developments on U.S. fuel prices was significant, if not dramatic. Fuel oil prices tumbled 34.5% from $1.119/gal to 73.3 cents/gal. Natural gas residential prices last year dropped 6.7% nationally, and elec-

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tricity prices declined 5.56%.

The drop in oil prices couldn't have come at a worse time for the natural gas industry, which was attempting to work its way out of an oversupply "bubble" that's been with the industry for several years. Now it appears it will be the 1990's before equilibrium is restored.

There were some meaningful shifts in fuel usage last year. The sharp drop in world oil prices led to a corresponding price drop for residual fuel oil, a major competitor of natural gas in the industrial and electric utility markets.

Traditionally, these two markets account for more than half of total natural gas sales. Last year, industrial gas sales were down 24.4% and sales of gas for electricity generation were down 37.1%. Together, they now account for only 35.7% of natural gas sales.

Commercial gas sales were down only 3.6%, thanks in part to a growing practice among large building owners to negotiate for gas with wellhead and pipeline companies for direct deliveries.

Although total residential gas sales were down marginally, gas improved its penetration of the new-home market last year. The industry's frustration is that, in areas of the country with the most new housing construction potential, the gas distribution infrastructure is weakest.

The economy

Even though the economy is entering its fifth year of recovery from the 1982 recession, there isn't all that much to cheer about. The gross national product (GNP), less inflation, grew at only 2.5% in 1986 to $4.208 trillion. We'll be lucky to achieve that growth this year.

In there's any consolation, it's that there still is no recession in sight. The "borrowing" of 1987 growth by the auto- and tax-related splurge late in 1986 should be absorbed by midyear. From then on, the economy should grow at a faster rate. But don't expect a boom.

It should be remembered, too, that today's growth scenario is a misnomer for many. Areas of the nation dependent on the petroleum industry, agricultural areas dependent on exports to a world overflowing with surplus food, and industrial areas adversely affected by foreign competition at home and abroad, still are hurting. And even though they may have hit bottom, they can't expect much relief this year or next.

Economic growth in 1986 was due in large measure to the growth in consumer spending, which accounts for nearly two thirds of the GNP. It was 1.5% greater than GNP growth and the result is that consumer installment debt is at an all-time high of 19.7% of disposable income.

As it turns out, that isn't all that bad. Home mortgages and installment payments (40% of it for autos) make up virtually all consumer debt. The surge in auto sales late in 1986 to take advantage of low-interest incentives and sales taxes resulted in $50 to $75/month lower car payments for many.

And the unprecedented $180 billion in home mortgage refinancing, triggered by the 5% drop in mortgage rates, resulted in increased debt but saved those homeowners $100 to $150 a month in mortgage payments. Add to those the $500 million that consumers saved at the gas pumps because of lower oil prices.

These factors, however, will not help much in 1987. Much of the pent-up demand for cars and mortgage refinancing has been satisfied. Oil prices are headed back up. Saving rates are down to 4%. And most wives already are working. The rising delinquency rate indicates that many consumers have all of the debt they can handle, especially in an age where both white and blue collar wages are increasing only marginally.

The lower value of the dollar (down 40% against the yen, 25% against the German mark) is not all positive. The Japanese are looking for lower-cost components in the world market to retain their export levels and, as a hedge against growing U.S. protectionism, establishing more production facilities in the U.S.

For the air conditioning and refrigeration industries, the once $1.5 billion positive trade balance enjoyed for many years was whittled to $337.8 million in 1986. Compressors and room air conditioners continue to lead the parade and are fast approaching the point where U.S. assembly could go beyond auto air conditioning compressors.

The federal deficit would be a much more serious burden were it not for the tremendous inflow of foreign investment. Some is oil profits and some from the wealthy in third-world countries who are looking for a safe haven for their assets. Lately it has been the Japanese investing the proceeds of their substantial positive trade balance.

This investment attraction, however, rests in part on the relative value of the dollar to other world currencies. So far, at least, the declining value of the dollar in world markets has had little effect.

U.S. economic growth in recent years also has been characterized by too-high unemployment and interest rates. Unemployment continues at 6.7% nationally, still well above the 4.5% to 5% considered normal in times of full employment. And because of regional troubles, it continues in double digits for several large areas.

Interest rates, while far below the usurious peaks of only a few years ago, still are too high to stimulate industrial expansion or, more importantly, modernization. In a climate where producer prices declined by 2.5% last year, industry simply cannot borrow money at today's rates and make a profit.

Instead of investing in plants and equipment, the nation's leading producers are using their considerable cash reserves to buy back outstanding stock and engage in a frenzy of mergers and acquisitions. In the industries served by The News alone, there were nearly 100 mergers and acquisitions last year. And it goes on because there is more money to be made there than in improving productivity.

Interest rates were stable through much of 1986. This year the prime rate continues at 7.5% and fixed-rate mortgages have eased downward to near 9%. The Veterans Administration guaranteed rate is 8.5%. There is little hope that mortgage rates will decline any further. In fact, they may ease upward later in the year. Inflation, at less than 2% last year because of the oil price drop, should reach a still-reasonable 3.5% to 4% this year.

One of the main reasons why interest rates continue to hold at more than 3% above inflation has been the high rate of government borrowing to finance a budget deficit that reached $220 billion in fiscal 1986. The Gramm-Rudman target of $152 billion for fiscal 1987 probably will be met but, because many of the reductions are one-shot deals, the road ahead still is rocky. And given the composition of the 100th Congress, tax increases are a likely possibility.

In fact, as business is finding out, the lower rates contained in the new tax law are deceptive. The loss of business tax credits, accelerated depreciation, and other incentives more than makes up for the difference.

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AIR CONDITIONING

The contrasts that characterized the rest of the economy also affected the world of comfort cooling.

In 1986, the industry witnessed record shipments of unitary air conditioners and heat pumps. New home construction was reasonably strong. The replacement market lived up to expectations. And light commercial construction clipped along at a good pace. Heady stuff.

Other major product areas were not so fortunate. Even though the declines were not substantial, the 22% decline in office building construction and the prospects of additional retrenchment in the years ahead took the bloom off the big system market. It, like multifamily rental housing, was a victim of a new law that removed the incentives that led to today's overbuilt condition.

Regionality was a characteristic of the 1986 market that also promises to continue as the unitary industry segment prepares for a flat year at record levels. But look for heat pumps and big system components to slide back somewhat this year.

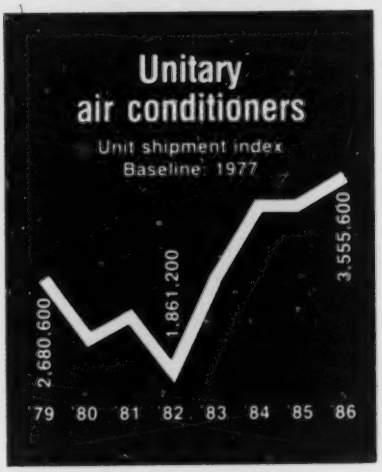
Total shipments of U.S. unitary air conditioners (including air-to-air heat pumps) in 1986 increased by 8.1% to a new record of 3,555,630 units, according to the Air-Conditioning and Refrigeration Institute (ARI). The 1985 total was 3,290,510 units, just a hair below the previous record of 3,308,428 units set in 1984.

The last three 3 million-plus years in a row were a far cry from the 1.86 million units shipped in recession-stricken 1982. They represented the first time industry shipments had crossed the 3 million mark and, already, the burgeoning replacement market has some expecting a 4 million-unit year by 1990.

ARI reported that shipments in January, 1986, were slightly behind the record set a year earlier but, for the 10 months from February through May, and from July through December, shipment records were set. June, 1984, still holds the single-month shipment record of 419,109 units.

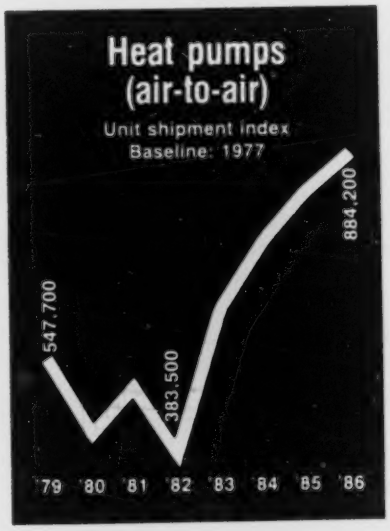
These figures do not include air conditioning units and air-to-air heat pumps shipped to foreign markets. In step with U.S. hvacr equipment generally, exports of unitary air conditioners declined again last year. The drop was 3.3% from a total of 80,224 units in 1985 to 77,618 units in 1986.

It should also be remembered that these export figures include only those units shipped directly to foreign destinations by oem's (original equipment manufacturers) and include few, if any, units shipped by distributors or contractors.



Of the 3,290,510 unitary air conditioners shipped in 1985, ARI reported that 82.4% — or 2,711,380 units — were for residential applications and 17.6% — or 579,130 units — were for commercial applications.

In recent years the ratio has moved gradually in favor of residential applications and away from the 78%-22% split that held sway through much of the 1970's. It is, however, in sharp contrast to the ratio posted in 1953, the first year these statistics were available. At that time, 66.9% of unitary shipments went into commercial installations and only 33.1% went into homes. The residential share passed the commercial two years later and, in 1973, the 78%-22% ratio was achieved.



If we accept that the 1985 split held true in 1986, then 2,929,839 units — or 82.4% — were destined for residential applications and 625,791 units — or 17.6% — were destined for commercial applications.

The unitary category includes electric air conditioners, gas air conditioners, air-to-air heat pumps, and rooftop equipment. It does not include packaged terminal air conditioners (ptac's), packaged terminal heat pumps, room air conditioners, heat pump water heaters (air-to-water heat pumps), or water-source heat pumps.

Inventory

The inventory of unitary air conditioners at the end of 1986 totaled 947,411 units, up 18.4% from the 800,462 units in inventory at the same time a year earlier. As a percentage of total shipments, the 26.7% was 2% more than in 1985, but still lower than the 30% to 33% range considered normal for much of the industry's history.

This fourth year with relatively low inventories, particularly at the factory level, confirms a major improvement in distribution efficiency among both independent wholesaler-distributors and factory branches. Forecasting programs instituted by both major wholesaler groups have been a significant factor.

Inventory levels are particularly important in a year like 1987. Even though installation rates may stay relatively constant, the mix this year probably will change significantly as new multifamily requirements decline and the replacement market continues to build.

Of the total end-of-1986 inventory, a total of 392,255 units — or 41.4% — were at the factory and 555,156 units — or 58.6% — were at the distributor level. This split was similar to that at the end of 1985, but in sharp contrast to the 49%-51% split in favor of distributors at the end of 1983.

It might also be a good idea to look at heat pump inventories. At the end of 1986, the heat pump inventory totaled 293,434 units, up 36% from the 215,650 units in inventory at the same time a year earlier. Of these, 114,217 units, or 39%, were at the factory and

179,217 units, or 61%, were at the distributor level.

The factory-field ratio was similar to the experience of a year earlier. But, significantly, heat pump inventory as a percentage of shipments jumped from 26.3% at the end of 1985 to 33.2% at the end of last year. This development, coupled with market shifts, could spell trouble in terms of competitive pricing during the first half of 1987.

Capacity mix

An indication of capacity mix for 1986 unitary air conditioners, and how it compares with the 1972 experience, follows:

	% 1972	% 1986
Under 1.8 ton	16	12.9
1.8 ton to 26,999 Btuh	23	20.7
2.25 ton to 32,999 Btuh	17	17.9
2.75 ton to 38,999 Btuh	22	21.3
3.25 ton to 43,999 Btuh	6	7.2
3.67 ton to 53,999 Btuh	7	8.1
4.5 ton to 64,999 Btuh	6	7.7
5.4 ton to 96,999 Btuh	1	1.6
8.1 ton and larger	1	2.5

Installed value

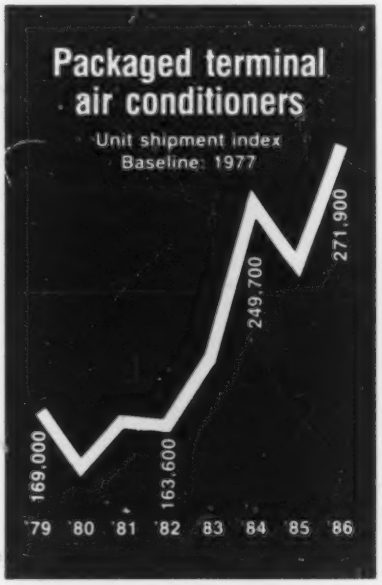
The installed value of unitary air conditioning equipment put in place in 1985, the latest year for which these figures are available, was $9,146,303,000, an increase of 2% from the $8,963,353,000 total for 1984, according to ARI's Business Research Department.

Of the total, ARI estimated that the total value of commercial unitary installations was $2,999,588,000, or 32.8% of all unitary installations. The total value of residential installations was $6,146,715,000, or 67.2% of all unitary installations.

Looked at another way, the commercial sector accounts for only 17.6% of unit shipments, but $32.8% of installation dollars. Similarly, residential installations account for 82.4% of unit shipments but only 67.2% of installation dollars.

Installed value covers the cost of unitary air conditioning equipment as shipped from the factory, together with labor, ductwork, registers and grilles, thermostatic and other controls, electrical wiring, and other components of the system installed by contractors.

The installed value of field-engineered systems put in place in 1985



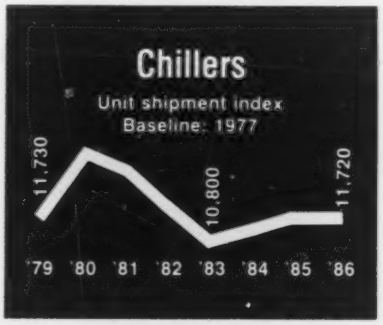
was $6,515,994,000, an increase of 22.9% over the previous year's installed value total of $5,303,865,000.

The combination of the two installed value totals in 1985 was $15,662,297,000, an increase of 9.8% over the 1984 total of $14,267,318,000. The $15.7 billion total covers all comfort cooling systems, with the exception of room air conditioners, put in place in the U.S.

In determining the installed value of field-engineered air conditioning systems, ARI estimates that only 7.5% of the cost of the system is represented by the cost of the refrigerating machine. The remaining 92.5% represents air-handling equipment, labor, ducts, pipes, controls, and all other installation costs.

Ptac's

After a brief dip a year earlier, the upward climb of packaged terminal air



conditioners (ptac's) continued in 1986. Shipments of ptac's last year totaled 272,000, up 19.7% from the 1985 total of 227,200 units.

The 1985 figure was 9% below the 249,700-unit total of a year earlier and represented the only interruption in the steady upward climb of ptac's since 1982.

This product has done particularly well in the hotel-motel, nursing home, and suburban office park markets, all of which held up well last year. In fact, ptac's compete head-on with commercial rooftops in the lower tonnage end of the market and with field-engineered central systems at the high end of the market.

Heat pump versions, known as packaged terminal heat pumps, accounted for 52% of ptac shipments last year. This share, which was only 40% in 1983, appears to have stabilized over the past three years.

It might be noted that the Bureau of the Census reported 172,256 ptac's were shipped in 1985, the latest year for which these figures are available, down 6.8% from the 184,780 units the bureau said were shipped in 1984. Additionally, packaged terminal heat pumps, at 81,964 in 1985, were down 12.3% from the 93,459 units shipped in the previous year.

As can be seen, the Census Bureau figures vary considerably from those collected by industry. Some believe that it's because some room units have been inadvertently included on the government reporting forms.

Ptac's are self-contained refrigeration cycles capable of being combined with such heat sources as electric resistance, steam or hot water coils, in the same through-the-wall cabinet. The heat pump version uses outdoor air as a primary heat source and may or may not contain a supplementary electric or hydronic back-up heat source.

Heat pumps

Air-to-air heat pumps, once considered creatures of the South and temporary expedients to natural gas curtailments, have shown surprising strength in both the residential and commercial rooftop markets.

Instead of fading into the background when natural gas again became widely available at the turn of the last decade, heat pumps gained in penetration. Those gains held until

last year.

Shipments of air-to-air heat pumps in 1986 totaled 884,203 units, a figure that reflected both a 7.5% gain over the 820,623 total for 1985 and set an annual shipment record for the third year in a row. Heat pumps set monthly shipment records in nine of the twelve months. Only the 1985 records for January, August, and December survived.

In contrast to the previous year when shipments of straight cooling units declined by 3.6%, the 7.75% increase in heat pump shipments in 1986 was matched by an 8.2% increase in shipments of cooling-only units.

As exciting as last year's performance of air-to-air heat pumps may have been, it's probable that 1986 set the high-water mark for heat pumps for several years to come. There are several reasons for that conclusion.

There is the initial problem of an extra 500,000 multifamily units, most of them in the South where heat pumps still derive most of their strength, which must be absorbed before the market can again expand. That's likely to take four or five years.

Too, the construction of single-family homes in the South, where heat pumps have been capturing nearly half (44.8% last year) of the market, is not expected to expand significantly in the next couple of years. Heat pumps also have lost market share in the Northeast, mostly to oil and hydronic systems, and to a lesser extent in the Midwest and West, mostly to gas furnaces.

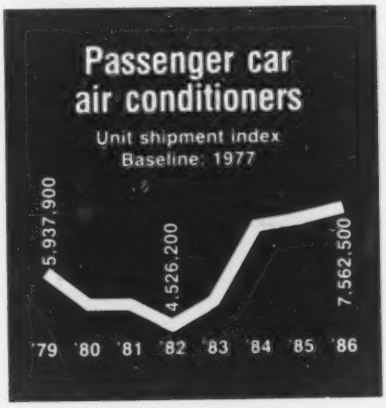
Although the growth in replacements will more than make up for the cooling-only system new construction losses in 1987, the replacement base for heat pumps simply is not large enough to carry the load. The Energy Information Administration (EIA) estimates that, of the 3.1 million heat pumps in U.S. homes in November, 1984, only 1.3 million were installed in homes built prior to 1974.

For these reasons, then, we have trimmed our 1987 heat pump expectations to a total of 820,000 units, a bit more than 7% off the previous year's pace but still a very substantial number. Two years ago it would have set a record and it would be more than double 1982's total.

On the positive side of the ledger is the fact that, when new home construction in the South revives, heat pump shipments probably will come back apace. Natural gas, the heat pump's chief competitor, does not have the distribution infrastructure in much of the South and Middle Atlantic states where heat pumps are strongest.

The limited market for add-on heat pumps used in conjunction with new and existing gas, oil, and electric furnaces would appear to have peaked and, for the past two years, been in decline. The approach was sparked by steep fuel price increases. Not only have fuel prices begun to decline, but the availability of high-efficiency furnaces has removed the economic incentive for these add-on units in most markets.

Meanwhile, in the wings, the gas industry continues its development work on gas-fired heat pump prototypes and a consortium of Japanese companies continues to develop gas engine-drive heat pump technology.



The air-to-air heat pump figures included in the unitary totals supplied by ARI do not include all heat pumps made in the U.S. To these should be added ptac's in heat pump (reverse cycle) configurations, water-source heat pumps (both earth-coupled and closed-loop), air-to-water heat pumps used to heat domestic hot water, and room unit heat pumps.

Water-source units

Shipments of water-source heat pumps, which amounted to only about 40,000 units in the mid-1970's, increased by 8.9% last year to 147,200 units. The total for 1985 was 135,200 units.

These units usually divide naturally into two separate markets, although there is some crossover. The oldest segment uses closed loops tied to a small boiler and cooling tower or evaporative condenser to maintain a loop water temperature between 60° and 90°F. They take advantage of load diversity and usually are applied in high-rise apartments or condominiums and in small- and medium-sized office buildings.

The other group initially used water from a pond, a well, or the ocean at temperatures as low as 45° and were largely confined to rural or exurban areas. This market has swung over sharply to vertical or horizontal ground loops filled with a heat transfer fluid (usually water and propylene glycol) to provide comfort heating and cooling at high efficiencies.

These largely water-to-air and a few water-to-water systems do not have to depend on the quantity or quality of the ground water. Pumping costs are reduced, defrost cycles are eliminated, and they can be sized for the design heating load so that no back-up heat source is required. They also can be applied in urban areas on small lots.

Most, although not all, of these ground-coupled heat pump systems are applied to single-family homes. They do, however, have a comparatively high first cost and require specialized application knowledge — factors that are likely to limit these systems to steady, but unspectacular, growth.

Heat pump water heaters

Domestic hot water in U.S. homes traditionally has been heated in natural gas- and electric resistance-fired storage tanks. A few homes use LP gas and oil burners to heat hot water and a few, particularly in the Northeast and Midwest, use a water jacket on gas- and oil-fired boilers.

Instantaneous hot water heaters of the type popular in Europe so far have made little impression on the North American market. Instead, increasing energy prices have motivated homeowners to add extra insulation to storage tanks, add solar assist, and use desuperheaters in areas where the operating hours of air conditioners and heat pumps justify the extra installation cost.

The air-to-water heat pump, with an installed cost more than twice that of an electric resistance water heater, entered the market seven years ago with a promise of 40% operating cost savings. Instead of capturing a healthy chunk of the 7-million annual water heater market, today's market is probably less than 10,000 units. Most of them are going into military housing projects. Moderating energy price es- [illegible] and a long-standing division

between plumbing and air conditioning trades were blamed for its demise.

Not so for a relatively new product called the integrated appliance. These systems use a conventional gas-fired storage domestic hot water heater piped to a hot water coil in a separate air handler. Electric water heaters do not have a recovery rate fast enough for these systems.

The system, which can easily accept an air conditioner's evaporator as well, uses the hot water heater for space heating and saves on fuel bills by utilizing much of what had been water heater standby storage losses. Special fittings on the hot water heater keep the plumbing and air conditioning mechanics from having to concern themselves with each other's system.

There are no figures available for these systems as yet, but there is no doubt that the market is growing. It is being helped by a growing number of gas utilities who, after falling victim to the overwhelming separate metering trend for apartments and condominiums, now have a system that can get them back into such projects.

Rooftops

Even though their big brother field-erected systems faced a decline in 1986, commercial rooftops managed a small increase. According to our calculations, rooftop shipments last year totaled 145,900 units, up 2.6% from the 142,200 rooftops shipped in 1985.

Shopping center and other light commercial and industrial construction tends to follow closely behind the housing market. There are strong indications that this market will at least hold its own through the next year.

Not to be forgotten is the growing importance of the replacement market. Not only are the early rooftops of the 1960's and early 1970's inefficient by today's standards, many of them are worn out. We estimate that 45% of the commercial rooftops being shipped today are going into the replacement market. Replacements could account for 60% of the total market by the end of the decade.

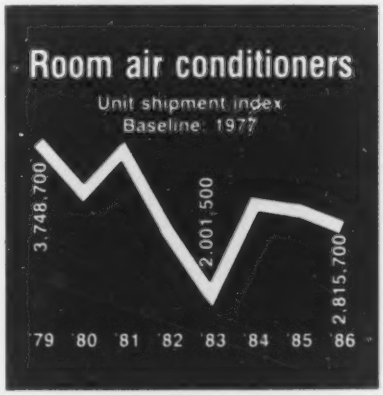
Commercial rooftops really represent a market application of several different products rather than a single product type that can be identified statistically.

For example, all-year units are identified both by ARI and the Bureau of the Census and clearly imply a heating capability. However, both single-package and split-system rooftops, although they may have been shipped (and counted) as cooling-only units, may have a modular heating section added in the field.

Too, heat pumps imply one and usually two methods of heating as well as a cooling capability. Another complicating factor is that small, all-year rooftops are applied in more residential than commercial situations.

The News bases its assessment of the commercial rooftop market on the known number of unitary shipments in 1986 and 1985 of 5.4 tons or more, and by past ARI and Census Bureau data on system types by size and (residential/commercial) application.

Although not as up to date as we would like, the exercise produces a breakdown within a few percentage points of the latest ARI figures by size of product. We have arbitrarily selected 5.4 tons as the starting point for commercial rooftop sizes even though some may wish to call all commercial units rooftops.



By applying the known (and latest) 1985 ARI ratio to both 1985 and 1986 ARI unitary shipment figures, we find that there were 604,300 commercial units shipped in 1986, an increase of 8.1% from the revised total of 559,200 commercial units shipped in the previous year. We also found that, in 1986:

- 249,200 were split systems, of which 39,200 had capacities in excess of 5 tons.
- 131,500 were all-year single packages, of which 58,600 had capacities in excess of 5 tons.
- 89,300 were cooling-only air conditioners, of which 31,900 had capacities in excess of 5 tons.
- 200 were multizones, all of which had capacities in excess of 5 tons.
- 134,100 were heat pumps, of which 16,000 had capacities in excess of 5 tons.

Taken together, 145,900 were commercial rooftops with capacities in excess of 5 tons. This leaves 458,400 commercial units with capacities of 5 tons or less that may also be classed as rooftops. We know there are more than 100,000 three-phase commercial units in that smaller category, just as we know there are residential units in the over-5 ton grouping. We simply don't know how to separate them accurately.

According to Ward's Automotive Reports, there were 7,562,508 air conditioning units installed on U.S. domestic automobiles in the 1986 model year, up 2.4% from the 7,382,673 factory air installations made in the 1985 model year.

The performance of factory air installations was slightly better than the performance of the domestic auto industry as a whole. Production increased marginally (0.8%) from 8,472,599 units in the 1985 model year to 8,543,732 units last year.

The difference is accounted for by the shift in penetration rates from 87.1% of all domestic autos produced in the 1985 model year to 88.5% of all cars produced in the U.S. in the last model year.

For cars made in the U.S., virtually 100% of luxury and full-size models are air conditioned at the factory. And, as can be seen from the penetration figures, most smaller cars also come equipped with comfort cooling.

Less than half of most subcompact models are equipped with air conditioning at the factory. This is partially because they are the least expensive cars and air conditioning is the most expensive option. Engines, too, are smaller. This is an important consideration, especially when coupled with an automatic transmission.

It might also be noted that 2,324,643 of the 3,696,865 light trucks produced in the U.S. in the 1986 model year were equipped with factory air conditioning. That's an increase of 6.73% over the 2,178,098 light trucks air conditioned in the 1985 model year, according to Ward's.

Again, the penetration of air conditioning in light trucks has increased steadily from 54.9% in 1983 to 61.3% in 1985 and 62.9% in the last model year.

Although 1986 figures are not yet available, the Bureau of the Census reported that, in 1985, a total of 10,348,538 open-type automotive air conditioning compressors were

shipped, up 1.8% from the 10,169,789 auto air compressors shipped in the previous year. For some unknown reason, the Census Bureau also tossed screw compressors into this category. Because of the relative shipment size differences, however, there should be little distortion.

The Census Bureau also reported that 13,008,516 auto air conditioning systems were shipped in 1985, an increase of 6.7% over the previous-year total of 12,196,385 units. Additionally, the Bureau reported that 2,154,467 mobile air conditioners for trucks, agricultural, and off-road construction vehicles were shipped in 1985, an increase of 10.6% over the 1984 total of 1,948,655 units.

It's also interesting to note that, according to Department of Commerce figures, the U.S. imported 3,094,245 automotive air conditioning compressors in 1986, up 15.9% from the 2,669,966 compressors imported in 1985. Last year the U.S. also imported $206 million worth of auto air conditioners and parts. Almost all of the imports were from Japan.

Aftermarket shipments of auto air conditioners, which declined steadily from 1978 through 1983, climbed back with the domestic auto industry after a painful series of shakeouts. Although no figures are available, International Mobile Air Conditioning Association executive director Paul M. Allen believes the industry has stabilized at a relatively high level of activity.

Even though the agricultural and truck markets are down, the recreational vehicle market has stabilized and growth is coming from such foreign subcompacts as the Yugo, which are not air conditioned at the factory.

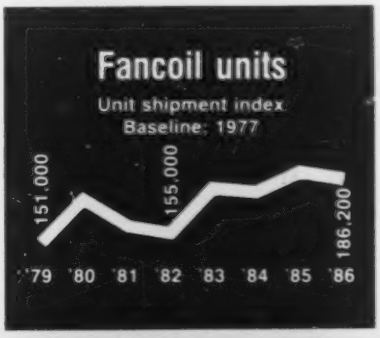
And despite the high penetration of factory air in domestic vehicles, this market picked up dramatically last year, he said.

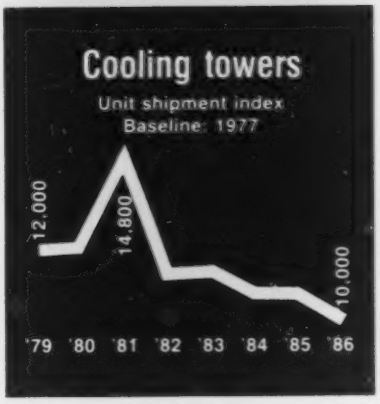
The growth segment of the industry today is parts sales, he said. Because owners are keeping their cars longer, and because average vehicle life now is 7.6 years, more repairs are being made. It's also estimated that the Japanese have captured 80% of the aftermarket air conditioner compressor market.

Faced with competition at home from central systems and imports, and competition abroad from Japan and Brazil, room air conditioners are having a tough time, according to the Association of Home Appliance Manufacturers (AHAM).

Shipments in 1986 totaled 2,815,700 units, a decline of 6.8% from the previous year's total of 3,021,900 units. It was the second decline in a row after a climb from the 2 million-unit year in 1983, and represented less than half the number shipped in the boom years of the 1970's.

For a country that once routinely exported a quarter of its room unit production, the change has been dramatic. In fact, the U.S. became a net importer of room units in 1981, the same year the Japanese succeeded the U.S. as the leading exporter of room units.





Exports of room units last year totaled 64,207 units, down 16.8% from the 77,181 room units exported in 1985, according to the Department of Commerce. That's only 2.3% of total production.

Imports, on the other hand, have grown rapidly. The U.S. imported 375,879 room air conditioners in 1986, an increase of 45% over the 259,200 room units imported the previous year — and 165% more than the 141,731 room air conditioners imported in 1984.

While shipment totals are going down, room unit efficiencies are going up. The average room air conditioner in 1985 used 1,002.4 kWh/year of electricity (based on 750 hours of operation), or 21.8% less than the 1,281.8 kWh/year for the average unit in 1972.

AHAM's high-efficiency category, units with EER's of 8.5 or over, accounted for 39.2% of shipments in 1985, up from 11.4% in 1980 and 10.7% in 1974. At the same time, shipments of units with EER's less than 6.5 accounted for 18.4% of shipments in 1985, down from 36.9% in 1980 and 52.3% in 1974. The EER range from 7.5 to 8.4, which accounted for only 9.2% of shipments in 1974, increased to 26.4% in 1985. The mandatory federal minimum efficiency standards for these units become effective in 1990.

Room units continue to be largely an impulse purchase. Shipment totals depend heavily on whether the summer is hot or cool.

Chillers

Even though the total chiller market held its own in 1986, the year's experience was, perhaps, the lull before the storm. Many of the construction markets on which this equipment depends, particularly office buildings, are in decline.

Chiller shipments in 1986 totaled 11,726, down only 0.5% from the 11,780-unit total recorded in the previous year. The level is above the depression of 1983, but far below the 14,500-chiller total recorded in 1980.

The 3,730 centrifugal chillers shipped in 1986 shows a technical increase of 6.9% over the previous year's total of 3,490 centrifugal chillers. We say technical because the 1986 total includes open-type centrifugals and the 1985 total does not. In the past, we have speculated that open centrifugals account for 400 to 500 units. If that's true, then this market category showed a slight decline.

In 1986 there were 7,840 reciprocating chillers shipped, a decline of 3.9% from the 8,160-unit total for recips in the previous year. Last year's shipments of absorption units, at 156 units, was up 20% over the 130 total for 1985.

The market for chillers, an essential ingredient in field-erected air conditioning systems, has been hampered by an overbuilt domestic office building market that declined by more than 20% last year and promises a similar drop in 1987. Too, the hard dollar in the first half of the decade made it tough competing in foreign markets and manufacturers began making most of the 50-Hz equipment abroad.

The much weakened dollar promises

to make U.S. field-erected components more competitive in foreign markets, particularly in a Saudi Arabia that's now selling oil to the U.S. in quantity. The outlook at home is not so bright. Institutional building continues at a good level but in the other strong market, shopping centers, the trend is toward neighborhood and community centers that favor unitary approaches.

For the record, the Bureau of the Census reported that 13,734 reciprocating chillers were shipped in 1985, the latest year for which these data are available. The total represented a 0.3% decline from the 13,788 reciprocating units the bureau said were shipped in 1984.

The Census Bureau reported that 131 absorption chillers were shipped in 1985, a decrease of 14.4% from the 153 absorption chillers the bureau said were shipped in 1984. There were no meaningful figures on centrifugal chiller shipments because they might reveal the shares of individual manufacturers.

At year's end in 1986, bookings for centrifugal chillers were down about 10% and reciprocating chiller bookings were down 3%. A 17-year record of chiller shipments follows:

Year	Recip.	Cent.	Abs
1970	10,300	4,150	1,000
1971	10,000	4,000	900
1972	10,000	3,000	900
1973	10,400	4,100	800
1974	11,000	4,500	1,000
1975	8,250	4,950	700
1976	7,600	3,400	500
1977	8,900	3,000	450
1978	8,100	3,350	370
1979	8,100	3,350	280
1980	9,650	4,600	280
1981	9,250	4,300	240
1982	8,500	3,600	200
1983	7,500	3,100	140
1984	8,100	2,950	160
1985	8,160	3,490	130
1986	7,800	3,700	160

Evaporative condensers

Shipments of evaporative condensers for 1985, the latest year for which these figures are available, totaled 2,508 units, according to the Bureau of the Census. This represented an increase of 3.4% over the 1984 total of 2,426 units. The 1985 total was almost evenly split between those under and over 100 tons of capacity.

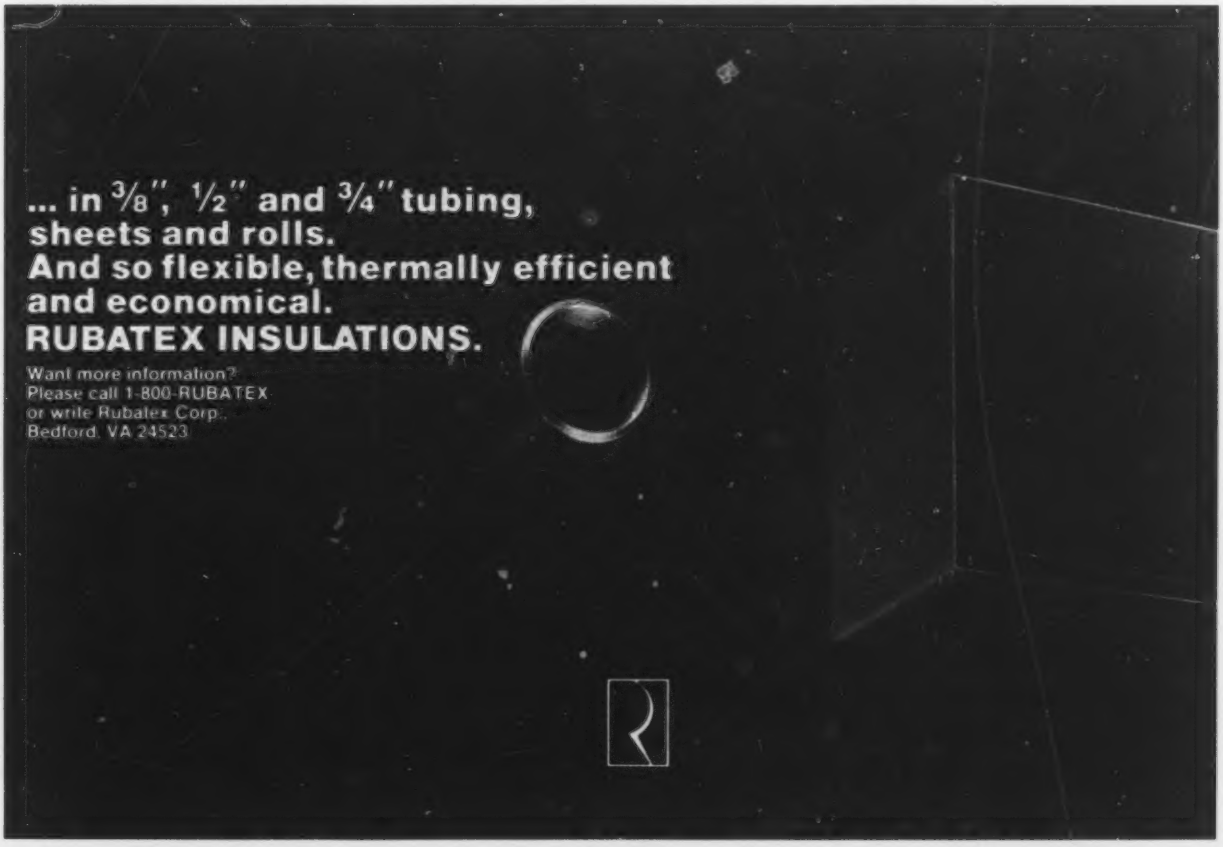
Fan-coil units

Domestic shipments of fan-coil units in 1986 totaled 186,500 units, down 1.2% from the 188,700-unit total for 1985.

Bureau of the Census figures, which include exports as well as those units destined for U.S. markets, show that 197,877 fan-coil units were shipped in 1985, the latest year for which these figures are available. That represents a 5.3% decline from the 209,001 units shipped in 1984. Of those shipped in 1985, 46% were vertical, 46% were horizontal, and 4% were vertical stack types.

Cooling towers

The only figures available for cooling towers are those collected by the Bureau of the Census. In 1985, the latest year for which these figures are available, the Bureau reported 10,787 cooling towers were shipped. This represents a decline of 0.6% from the 10,853 cooling towers the bureau said were shipped in the previous year.



REFRIGERATION

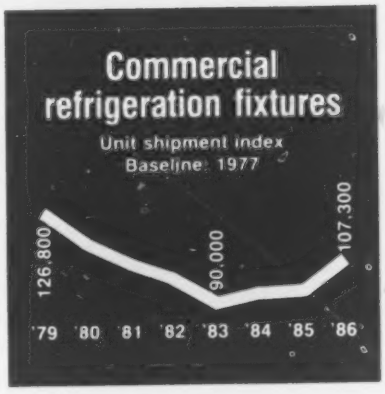
Unit shipments of commercial refrigeration equipment increased by 13.8% in 1986 over the market's performance in the previous year, according to the Commercial Refrigerator Manufacturers Association (CRMA).

The trade association does not report numerical totals for either shipments or for the various equipment categories. Based on the percentages supplied by CRMA, plus data published in prior years by the Air-Conditioning and Refrigeration Institute (ARI) and the Bureau of the Census, The News estimates that shipments in 1985 totaled 94,300 units. The increase in 1986 would bring the new total to 107,300 units.

CRMA reported that shipments of standard-temperature cases in 1986 increased by 14.3% over shipments in the same category a year earlier. We've been told that standard-temperature cases represent about 60% of the overall total.

Of the standard-temperature cases, shipments of reach-ins last year increased by 12.2%, island units increased by 32.2%, and "other" units increased by 23%. CRMA no longer provides figures on walk-in coolers.

Shipments of low-temperature cases increased by 13.1% in 1986 over shipments in this category in 1985. For the same period, shipments of single-deck cases increased by 12.7%, multidecks by 13.4%, and island unit shipments last year increased by 10.3%. Enclosed (glass door) low-temperature display case shipments last year were up 24.4% over 1985 performance.



Other views

Every five years the Bureau of the Census publishes figures on commercial refrigeration equipment that includes much more than the equipment normally used in supermarkets. In last year's Statistical Panorama, we quoted figures from the preliminary 1982 Census of Manufacturers. This year we are quoting from the final version of this report and the figures are slightly different. Dollars are current for the year reported.

According to the Bureau, the manufacture of commercial refrigeration equipment in 1982 totaled $1,070,800,000, an increase of 41% over the $759.4 million total for 1977.

The Census Bureau reported that 67,900 sectional coolers, prefabricated walk-in and roll-in coolers, and combination cooler-display units were shipped in 1982. There was not a comparable shipment total for 1977 but the dollar value increased by 40.8% from $158.6 million in 1977 to $223.3 million in 1982.

Standard-temperature reach-ins shipped in 1982 totaled 128,500 units, up 73.6% from the 74,000-unit total five years earlier. The dollar value, however, increased by 108.8% from $68.2 million in 1977 to $142.4 million in 1982.

The Bureau reported standard-temperature closed cases shipped in 1982 totaled 16,000 units, up 42.9% from the 11,200 units shipped in 1977. Open single-level cases were down 5% from 26,000 in 1977 to 24,700 units in 1982. Open multilevels were almost even. The total was 31,700 in 1977 and 31,300 units five years later.

Low-temperature reach-ins shipped in 1982 totaled 43,500 units, according to the Bureau, up 45.5% from the 29,900 units shipped in 1977. Ice cream dispensing-hardening cabinet shipments totaled 13,700 units in 1982, up 11.4% from the 12,300-unit total in 1977.

Open single-level frozen food display cabinets shipped in 1982 totaled 13,200 units, down 59% from the 32,200 units shipped in 1977. Open frozen food multilevel cases shipped in 1982 totaled 11,800 units, up 7.3% from the 11,000-unit total five years earlier. Closed frozen food cabinets, other than reach-ins, totaled 14,800 units in 1982, up 131.3% from the 6,400 units shipped in 1977.

We must emphasize that these Bureau of the Census figures include equipment that finds its way into convenience stores, restaurants, and industrial applications as well as supermarkets. Too, the Bureau reported that some of the quantities represent estimates with an error factor as high as 29%.

A private study published by Specialists in Business Information, Inc., Wantagh, N.Y., provides estimates of shipment value and some information on unit shipments. It, too, also covers such related areas as water and dairy coolers and restaurant equipment.

SBI estimates that the market for reach-in refrigerators and vertical display cabinets totaled $420 million in 1986. The market for other display cases and cabinets totaled $447 million last year and the market for walk-in, roll-in, and combination coolers was estimated at $361.2 million. In the period 1982 through 1986, SBI estimated that unit shipments of vertical display cases have increased by 54.5%, other display cases have increased by 42.2%, and walk-in cooler shipments have increased by 41.8%.

In 1986, SBI estimated that standard-temperature display case unit shipments totaled 100,100 units and that low-temperature display case unit shipments totaled 79,500 units. Of the standard-temperature cases, 23,800 were closed cases, 32,700 were open single-level cases, and 43,600 were open multilevel cases.

Of the low-temperature cases, SBI estimated were shipped in 1986, the researchers estimated that 17,600 were open single-level cases, 15,700 were open multilevel cases, 25,600 were closed (solid or glass doors) cases, 1,000 were ice cream counter freezers, and 19,600 were ice cream dispensing and hardening cabinets.

In the 62-page report, researchers speculate that commercial refrigeration shipments, on a current dollar basis, will increase at an 8.4% annual average compound rate and reach $3.87 billion by 1996. Unit sales are expected to increase by about 5% annually.

Supermarkets

In 1985 there were 30,505 supermarkets in the U.S. with annual sales of more than $2 million, according to the Food Marketing Institute (FMI). Total supermarket sales were estimated at $209.8 billion in 1985, the latest year for which this data is available.

Progressive Grocer magazine re-

TURN TO PAGE 26

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No one even comes close to Mother Nature.

And no one comes close to Scotsman. We're the largest producer of ice machines on earth.

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FROM PAGE 24

ported that, of the total, some 13,285 supermarkets (with $66.1 billion in sales) were independently owned and 17,220 supermarkets (with $143.7 billion in sales) were chain-owned. Of the total, 21,890 (71.8%) were conventional supermarkets, 4,400 (14.4%) were superstores with more than 40,000 sq ft and $8 million in annual sales, 3,365 (11%) were warehouse (economy) stores, and 850 (2.8%) were combination stores.

The magazine also estimated there were 45,400 convenience stores in 1985 with annual sales of $20.4 billion.

FMI reported that in 1985 (with comparable 1984 figures in parentheses), 3.1% (4.1%) of supermarkets were new, 9.9% (4.3%) were remodels, and 4.2% (6.9%) were closed. New stores continue to grow in size. The typical 1985 new store was approximately 40,000 sq ft.

The institute reported that energy costs in a typical supermarket often exceed rent payments which, in 1985, averaged $6.20/sq ft. Of the energy cost, 55% to 60% is for refrigeration, $15% to 20% is for hvac or comfort conditioning, and 10% to 15% is for lighting.

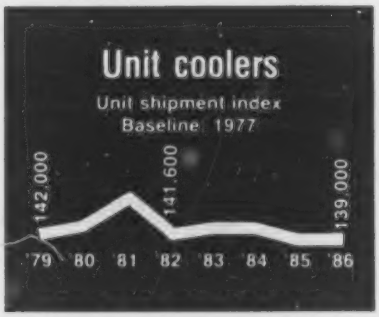
Of the new stores built in 1985, superstores accounted for 49.2%. The remainder included 21.5% conventional stores, 18.4% combination stores, 9% warehouse (economy) stores, and 2% other types.

Construction costs for new supermarkets in 1985 ran at about $60/sq ft, of which $29/sq ft was for equipment and fixtures. Remodels typically cost $17/sq ft and the total cost of a remodel in 1985 was $400,000, down from $500,000 a year earlier.

The popularity of bigger store formats still is a relatively new phenomenon. The majority of stores in operation at the end of 1985 were conventional outlets (53.9%). Superstores accounted for 32.5%, another 9.1% were combination stores, and 3.7% were warehouse stores.

Progressive Grocer reported that the consumer's continuing love affair with perishables has caused supermarket operators to install improved refrigerated cases so they can increase sales and control energy costs. This has been enhanced by the widespread expansion of service departments and a trend toward European-style display cases.

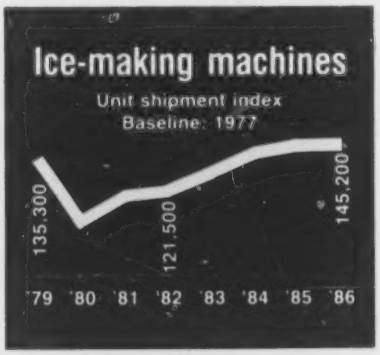
Among the most popular refrigerated case purchases are meat, deli, bakery, and dairy cases. Among freezers, those



with glass doors outpace open (coffin) cases two to one. Even though open multidecks are on the shopping list, the multidecks enclosed with glass doors outpace them four to one.

On the restaurant scene, the National Restaurant Association (NRA) predicted sales growth for the food service industry, adjusted for inflation, of 2.4% in 1987, down from 2.7% in 1986. The International Food Service Manufacturers Association (IFMA) is looking for a 1.6% industry gain in 1987 in real terms, off from 2% last year.

Above-average growth is expected for fast food restaurant chains, ice cream



stands, convention hall restaurants, and commercial catering. The strongest growth will be in the Mountain states and the slowest growth will be in the Middle Atlantic states.

NRA expects the food service market will reach $197.5 billion in 1987. It estimates that 88% of the growth will come from restaurants, bars, and lodging facilities. Institutional food service, at $22.4 billion last year, should increase by 2.9% in 1987 and military food services, at $1 billion, should be flat.

Refrigerators

Domestic refrigerator shipments totaled 6,510,400 units in 1986, up 7.1% over the previous-year total of 6,080,500, according to the Association of Home Appliance Manufacturers (AHAM).

The lowest interest rates in many years and a comparatively strong housing market should keep refrigerator sales this year close to that level. The drop in multifamily home starts, however, could nibble away 5% of last year's gains.

Shipments of home freezers in 1986 totaled 1,222,200 units, a decrease of 1.1% from the 1,235,800 home freezers shipped in the previous year. The 1986 breakdown shows that 661,100, or 54%, were chest-type freezers, and 561,200, or 46%), were upright freezers.

Unit coolers

Shipments of unit coolers, at 139,000 in 1986, were almost the same as the revised total of 138,900 unit coolers shipped in 1985.

It might be noted that the Bureau of the Census reported that 203,956 unit coolers were shipped in 1985, the latest year for which these figures are available. That represents a 13.5% increase over the 179,726 unit coolers the Bureau said were shipped in the previous year.

The industry figures do not include exports or the production of several significant manufacturers.

Ice-makers

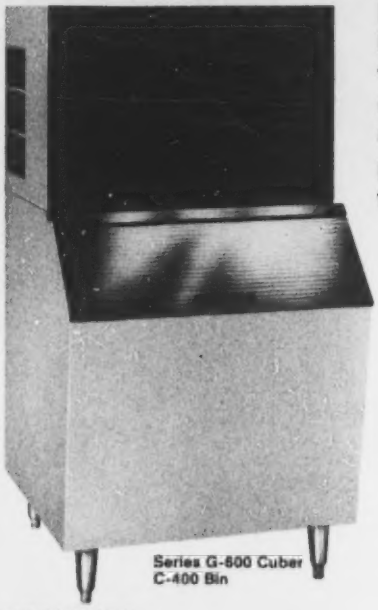
Sticking to the format of past Statistical Panoramas, shipments of ice-making equipment in 1986 totaled 145,200 units, an increase of 9.6% over the 132,500 ice makers shipped in 1985. Of these, The News believes that 82.5% were cubers and 17.7% were flakers.

In future years, we will add ice maker-dispenser combinations, a move that adds 86,700 units to the 1985 figures and 88,300 units to the totals for last year. The revised total for 1986, then, would be 233,500 units, up 2.5% from the 227,800 ice makers shipped in 1985. Remember, too, that these figures include both U.S. and export shipments.

The Bureau of the Census reported that 281,956 ice makers were shipped in 1985, the latest year for which these figures are available. This represents a 29.2% increase over the 1984 total of 218,281 units.

It's apparent that a major discrepancy still exists between government and industry figures. Both sets include domestic and export shipments.

MANITOWOC ICE CUBE MACHINES



Series G-600 Cuber
C-400 Bin

FEATURES AND BENEFITS

Design simplicity assures reliable operation for efficient and economical ownership. No problem-causing extras or gadgetry.

Component accessibility ensures speedy entry for fast service diagnosis and maintenance. Reduces service time and labor expense.

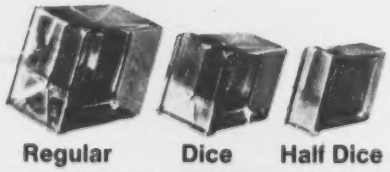
Five-year parts and two-year labor warranty on compressor and evaporator. One-year parts warranty on other components.

DESIGNED FOR YOUR REQUIREMENTS

- Maximum ice production in minimal floor space.
- Modular flexibility and stack-on versatility.
- Variety of ice cube maker models, dispensers and storage bins. Ice production from 100 Lbs. (45.4 Kgs.) up to 3,420 Lbs. (1,553 Kgs.).
- Woodgrain and "fawn" styling complements any decor. Stainless steel exterior also available.

THREE CUBE SIZES TO CHOOSE FROM

Select the best size to suit each icing requirement. Unique Manitowoc "Rhomboid" shaped cubes are easy to work with... resist nestling-up and freezing together in bin.



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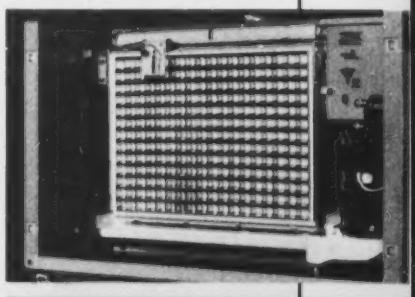
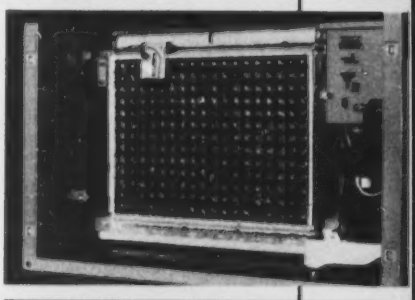
EFFICIENT SYSTEM USES LESS ENERGY

Patented vertical evaporator constructed of plated copper provides maximum heat transfer for fast freezing. Each cell acts as an individual five-sided freezing unit. Horizontal partitions placed on a downward slant permit cubes to release simultaneously by gravity — no need for cutting wires or punch bars.

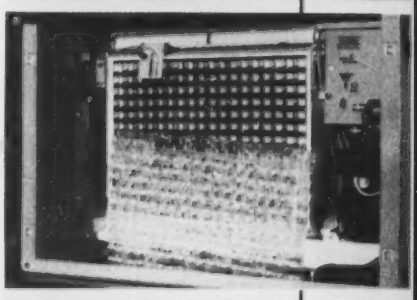


PRINCIPLE OF OPERATION

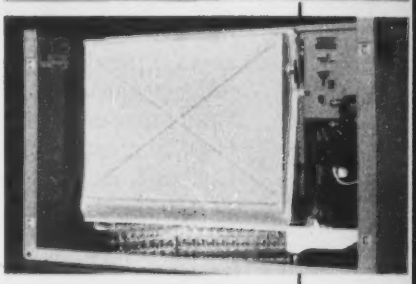
Water is pumped up into a distribution tube which directs it in an even flow across the front of the evaporator and into each cube section. Here it freezes until cube formation is complete.



When sufficient ice has formed, a sensor completes a low voltage circuit, initiating harvest. In this condition, hot refrigerant gas warms the evaporator and the cubes slide as a unit by gravity off the evaporator and into the storage bin.



The sliding cube unit swings the water curtain out which activates a switch, putting the ice maker back into the ice making mode. When the storage bin is full, the last cube unit holds the water curtain open, shutting off the ice maker. Removing ice from the bin allows the water curtain to return to its normal position. The machine will restart and a new ice making mode will begin.



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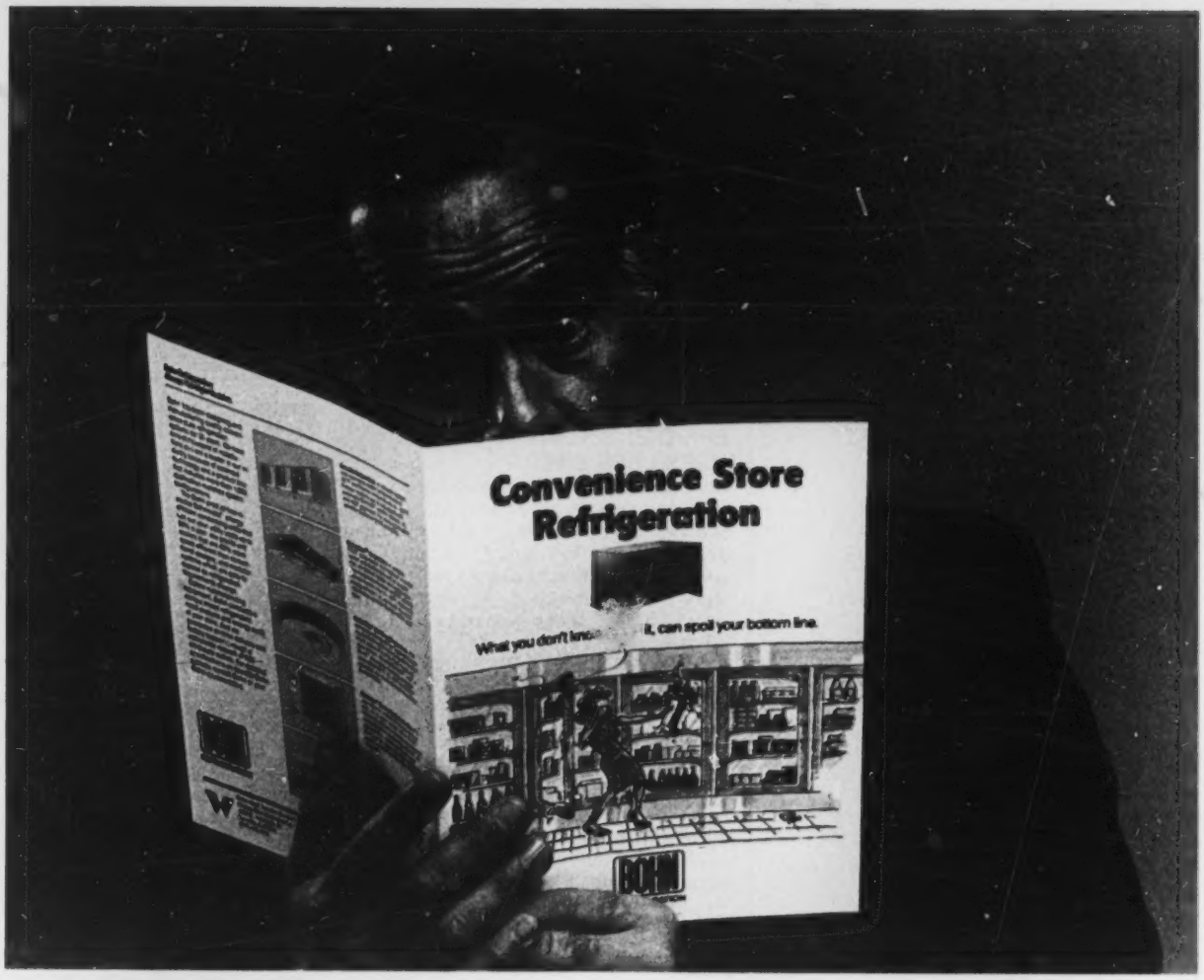

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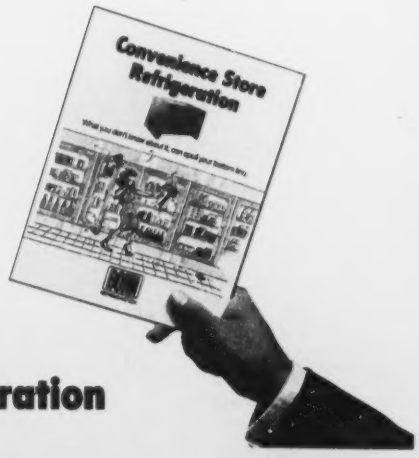

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HEATING

Unit shipments of gas- and oil-fired boilers in 1986, at 333,002 units, showed a 9.1% increase over the 305,224 boilers shipped a year earlier, according to The Hydronics Institute (HI).

Last year's increase, which comes on the heels of a 10.1% improvement in 1985, was almost entirely due to increased penetration in the new single-family home market. The penetration of hydronic systems increased from 4.3% in 1985 to 6.3% last year, a difference that accounted for an additional 28,500 residential boilers.

It should be noted, too, that home construction in the Northeast, the strongest market for hydronic systems, has been strong for the past three years and promises to be among the strongest markets in 1987.

Shipments of **cast iron boilers**, at 289,010 in 1986, were up 9.6% from the 263,594 year-previous total. Shipments of **steel boilers** increased by 5.5% from 41,630 units in 1985 to 43,922 units last year.

Even though gas-fired cast iron boilers still dominate the market in terms of total numbers, the growth surge that characterized the turn of the decade is long over. It was caused by a sharp increase in oil prices and the sudden availability of natural gas after nearly a decade of curtailments. In the last 18 months oil prices have dropped dramatically and the residential boiler market, already returning to a more historical ratio, reflected that fact.

The gas share of the cast iron boiler market, which soared to 85% in 1980, settled at a more normal 61.5% in 1986 — down from 64.8% in 1985 and 66.9% in 1984. It had dropped to 50% in 1977, the last year of widespread gas curtailments.

Oil's share of the cast iron boiler market in 1986 was 38.5%, up from 35.2% in the previous year and 33.1% in 1984. Oil held only a 15% share in 1980, a year which also saw many thousands of existing-unit conversions from oil to natural gas. The oil share only a few years earlier, in 1977, was 49.5%.

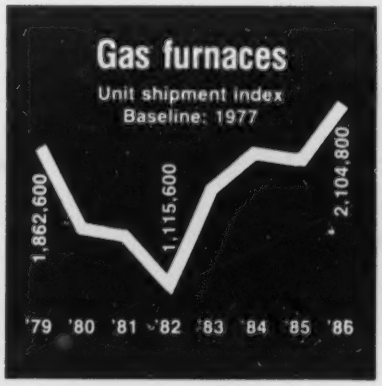
The share of cast iron hot water boilers, at 81.3% in 1986, was up slightly from the 79.9% share in 1985 and 77.8% in 1984. Conversely, cast iron steam boilers in 1986 accounted for 18.7% of shipments, down from 20.1% in the previous year and 22.2% in 1984.

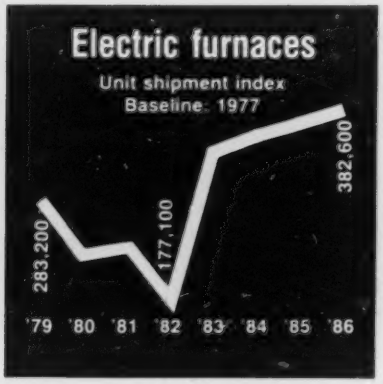
In the case of steel boilers, however, it is oil that dominates. The 38,811 oil-fired steel boilers shipped last year accounted for 88.4% of the total, up from 86.8% a year earlier. The 785 gas-fired steel boilers accounted for only a 1.8% share, down from 2.4% in 1985. The 4,326 bare (without burners) steel boilers shipped in 1986 accounted for the remaining 9.8% share, down from 10.8% a year earlier.

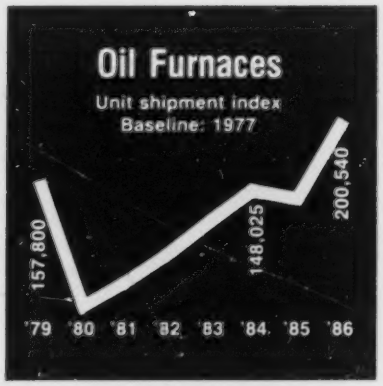
Radiation shipments in 1986, according to HI, were: **convectors** 1,678,219 sq ft EDR (equivalent direct radiation), down 0.65% from the 1,689,191 sq ft EDR total in 1985; **baseboard** 15,059,904 lineal ft, up 11.4% from the 13,513,745 lineal ft total in 1985; **commercial finned tube** 6,593,704 sq ft EDR, down 9.5% from the 7,286,380 sq ft EDR total in 1985. Expressed in terms of lineal feet, the 1986 total of 1,297,046 lineal ft of commercial finned tube was 11.8% less than the 1,470,082 lineal ft total for the previous year.

Total shipments of radiation products are far below those of only a few years ago but residential baseboard continues to make gains. In 1979, for instance, total radiation shipments amounted to 57.8 million sq ft EDR. The prime reason for the drop is the high ratio of boiler replacements, about 85% of shipments, where radiation already is in place. Gains in new single-family housing in the past two years, however, have produced meaningful gains in baseboard radiation shipments.

The absence of any substantial shifts in fuel prices and continued new single-family home strength in the Northeast and Midwest, heart of the







hydronic system's market, promises another good year for boilers in 1987. We think the increase will be a modest 2% to 340,000 units.

HI believes a 5% increase to 350,000 units is possible because of increased new home penetration and the availability of credit at reasonable rates for replacements.

It also notes a growing change in attitude toward comfort cooling by the hydronics industry. Four boiler manufacturers have taken on compatible air conditioner lines and the industry no longer regards cooling as a market adversary. Too, HI notes that an increasing number of air conditioning contractors are attending its hydronics schools.

Residential furnaces

Paced by a strong penetration gain in home construction and continuing strength in the replacement market, shipments of oil furnaces in 1986 totaled 200,540 units, up 36.2% from the 147,260 oil furnaces shipped in the previous year, according to the Gas Appliance Manufacturers Association (GAMA).

Oil furnace shipments have made a dramatic comeback since the recession early in this decade. In 1982, for instance, shipments totaled only 103,500 units. By 1984 the total had reached 148,000 units and, after a flat year in 1986, surged to 200,540 units last year.

Replacements have been an important factor in the recovery. Also important has been the increase in new home penetration by oil. Among single-family homes built in 1985 oil accounted for 2.6%, up from 2.1% a year earlier. Last year the oil penetration rate for new single-family homes reached 4.1%.

Among multifamily units, oil's penetration rate dropped from 0.8% in 1984 to 0.2% a year later and then surged to 1.3% last year. Virtually all of the increases have been the result of the sustained new home construction strength in oil's bastion, the Northeast.

In November, 1986, GAMA's members forecast that oil furnace shipments would decline by 2% in 1987. With the benefit of an additional four months of market experience, we believe that shipments this year will increase by about 2% to 205,000 units.

It should be noted that the Bureau of the Census reported that 137,026 oil furnaces were shipped in 1985, the latest year for which this data is available. This represents a 9.4% increase over the 125,249 oil furnaces the bureau said were shipped in 1984.

Here and elsewhere in this issue we will report Bureau of the Census figures when they are available even though they often vary considerably from industry figures. We favor the industry figures because they are more up to date and, in our experience, more accurate.

The 15.5% increase in **gas furnace shipments** — from 1,822,295 units in 1985 to 2,104,805 gas furnaces shipped last year — probably better reflects a geographic market shift more than technology or pricing.

The increase brought shipment levels well above the previous high-water mark of 1,862,600 units shipped back in 1979. It also represents a whopping 82% increase above the recent

1986 cast iron boiler shipments by thermal capacity

Gross output, Btu/h	Steam	Water	Total
Less than 50,000	717	10,759	11,476
50,000 to 74,999	1,179	25,975	27,154
75,000 to 99,999	8,038	47,921	55,959
100,000 to 124,999	15,558	68,016	83,574
125,000 to 149,999	5,429	31,109	36,538
150,000 to 199,999	9,349	27,512	36,861
200,000 to 249,999	4,759	11,854	16,613
250,000 to 449,999	4,296	7,501	11,797
450,000 to 949,999	2,268	2,268	4,525
950,000 to 1,549,999	1,317	453	2,270
1,550,000 and over	1,203	990	2,193
Totals	54,154	234,856	289,010

1986 cast iron boiler shipments by fuel

Gross output, Btu/h	Gas-fired	Oil-fired	Total
Less than 50,000	11,464	12	11,476
50,000 to 74,999	26,810	344	27,154
75,000 to 99,999	48,611	7,398	56,009
100,000 to 124,999	41,466	42,108	83,574
125,000 to 149,999	17,900	18,638	36,538
150,000 to 199,999	12,843	23,968	36,861
200,000 to 249,999	9,714	6,899	16,613
250,000 to 449,999	6,550	5,247	11,797
450,000 to 949,999	2,143	2,382	4,525
950,000 to 1,549,999	731	1,539	2,269
1,550,000 and over	573	1,621	2,194
Totals	177,757	111,253	289,010

low-water mark of 1,155,600 units shipped in 1982 at the bottom of the last recession.

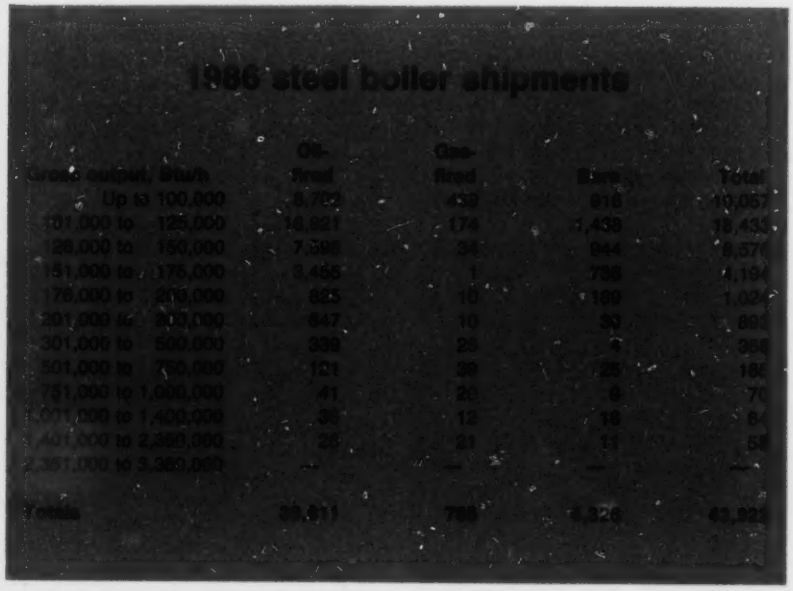
The gas share of the new single-family home market increased from 43.4% in 1985 to 46.8% last year. Although the gas share increased marginally in the South and West, it was in housing's growth markets — the Northeast and Midwest — where gas showed the strongest gains. The reverse was true among multifamily units built in the Northeast and Midwest, however, even though the gas share increased from 30.2% in 1985 to 33.4% last year.

GAMA's members feel that gas furnace shipments will drop about 2% this year to 2 million units. With the benefit of four months' hindsight, however, we feel that sustained single-family and condominium housing starts will keep gas furnaces about even with last year's exceptional performance.

For the record, the Bureau of the Census reported that 1,815,982 gas furnaces were shipped in 1985, the latest year for which this data is available. This represents a 4% increase over the 1,745,809 gas furnaces the bureau said were shipped in the previous year.

Gas-fired unit heater shipments held steady in 1986. Total shipments of 183,800 units last year represented a marginal 0.2% decline from the 184,188 units shipped in 1985. Of the total, 171,163 or 93.1% were propeller fan types and 12,637 or 6.9% were blower types. The propeller fan units held steady while blower types increased by 9.75% in 1986. GAMA expects an 8% decline in unit heater shipments this year to about 170,000 units.

It should be noted that the Bureau of the Census reported that, in 1985, a total of 287,533 gas-fired unit heaters were shipped up 11.3% from the 258,363-unit total for the previous year. Obviously the government figures include the outputs of manufacturers who do not participate in the industry program.



1986 steel boiler shipments

Gross output, Btu/h	Oil-fired	Gas-fired	Dual-fuel	Total
Up to 100,000	8,752	459	916	10,057
101,000 to 125,000	16,831	174	1,438	18,443
126,000 to 150,000	7,398	34	944	8,376
151,000 to 175,000	3,455	1	728	4,184
176,000 to 200,000	825	10	189	1,024
201,000 to 300,000	847	10	30	887
301,000 to 500,000	338	25	4	367
501,000 to 750,000	121	39	25	185
751,000 to 1,000,000	41	20	9	70
1,001,000 to 1,400,000	36	12	16	64
1,401,000 to 2,350,000	26	21	11	58
2,351,000 to 3,350,000	—	—	—	—
Totals	38,811	765	4,326	43,902

Gas-fired duct furnace shipments increased by 1.4% in 1986 to 21,168 units, according to GAMA. The 1985 total was 20,870 units. Duct furnace shipments in 1986 are expected to decline about 9.5% to 19,100 units.

Gas-fired residential wall furnace shipments in 1986 totaled 196,930 units, down 4.6% from the 206,430 units shipped in the previous year. Of the total, 65% were vented wall furnaces and the remaining 35% were direct vent systems.

The latest Bureau of the Census figures, which also include commercial and industrial wall furnaces, show a total of 318,627 wall furnaces were shipped in 1985, down 7% from the 342,559 units shipped in the previous year.

Shipments of **recreational vehicle heating systems** in 1986 totaled 208,043 units, up 3.1% from the 201,702 units shipped in 1985. This category, which includes direct-vent wall and central furnaces, is not expanded by GAMA to include the total industry.

Shipments of **gas-fired floor furnaces** totaled 21,874 units in 1986, down less than 1% from the 22,085 floor furnaces shipped in the previous year. This category, too, has not been expanded to include the total industry.

The Bureau of the Census reported that 25,117 gas-fired floor furnaces were shipped in 1985, the latest year for which figures are available. The total was almost the same as the 25,211 floor furnaces the bureau said were shipped in 1984.

Some perspective

Even though it's covered in more detail in "Comfort in Construction," we should point out that the volatility of fuel prices that has been a characteristic of the furnace and boiler markets for several years has continued unabated.

When the second major escalation in world oil prices impacted the U.S. in 1978, along with the sudden availability of natural gas after nearly a decade of curtailments, there was a wave of conversions to gas from oil and electricity. The decontrol of oil prices in 1981 only added fuel to the fire.

This wave of conversions subsided in the early 1980's, a victim of the recession and a rising tide of gas price increases of as much as 50% a year in the wake of increases in the controlled price of interstate gas.

Early in 1983, however, the price of industrial gas edged past the Btu-equivalent price of residual fuel oil and industrial and utility users, who almost always can fire boilers with at least two fuels, began switching from gas to heavy oil. Because the gas industry sold more than half of its output to this class of user, the price ceiling had been reached. When oil prices in late 1985 and 1986 dropped to $12/barrel and lower, the gas industry was in trouble.

Gas supplies are more than adequate for the near term. In fact, the industry does not expect to work its way out of the oversupply "bubble" until the mid-1990's. The fact that Btu-equivalent

natural gas sales to industry declined by 24.4% last year, and electric generation sales dropped 37.1%, will not help.

Other factors include the limitation of the natural gas distribution system in those South areas where homebuilding is expected to expand the greatest and the across the board increases in equipment efficiencies.

Last year, for example, 15.8% of all gas furnaces shipped had an annual fuel utilization efficiency (AFUE) of 86% or more. Another 15.1% had AFUE's in the 80% to 86% range. Only 13.5% of last year's shipments resembled the atmospheric furnaces that have been sold for decades and have AFUE's of less than 65%.

On the oil front, 52.4% of oil furnaces shipped last year had AFUE's of 80% or more and only 6.1% were below 75%. The electric industry has largely switched from electric resistance baseboard to heat pumps in an attempt to match operating costs with other fuels.

Electric furnace shipments, which tend to closely follow new home construction closely, totaled 382,590 units in 1986, up 4.5% from the year-previous total of 366,020 units. Modest shipment increases in 1986 and 1985 after a 92% increase in 1983 are really a reflection of how new home construction rates in the South — the electric furnace's strongest market — have moderated.

The primary role of the electric furnace has been to serve as a back-up heat source for air-to-air heat pumps and as the sole heat source for homes in relatively mild climates. GAMA's members look for a slight decline in this market in 1987 and we agree. It should not, however, be more than 5%.

Total **gas, oil, and electric furnace shipments** in 1986 amounted to 2,687,935 units, up 15% from the 2,335,575-unit total in the previous year. The 1986 furnace total eclipsed the previous record of 2,658,000 set in 1972 by just over 1%.

Looking ahead, we feel that the chances of another record in 1987 are slim. At the same time, however, we doubt that furnace shipments will slip more than 5%. While single-family homebuilding and replacements should continue strong through year's end, the perception of relatively stable fuel prices, low inflation rates, and exceptionally high consumer credit obligations will remove the urgency necessary for furnaces to gain much more ground.

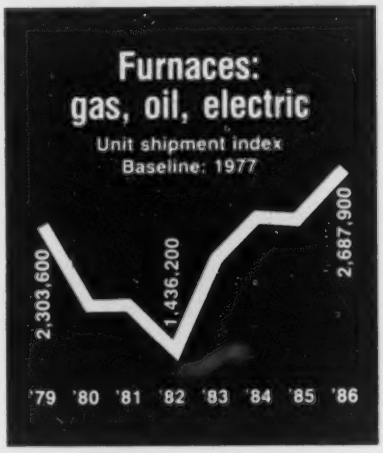
It must be remembered, too, that a plateau at or near record levels is hardly an unwelcome prospect.

In addition to the furnaces already covered, the Bureau of the Census reported 2,768 **gravity warm air furnaces** were shipped in 1985, the latest year for which data are available. That represents a decline of 10.8% from the 3,104 gravity warm air furnaces shipped in the previous year.

Forced-air furnaces fired by solid fuels (coal, coke, and wood) shipped in 1985 totaled 4,987, down 35.4% from the 1984 total of 7,721 units.

Shipments of **mechanical coal stokers** in 1985 amounted to 1,908 units, a decline of 4.5% from the 1,997 stokers shipped the previous year.

Similarly, the Census Bureau reported shipments of **electric unit heaters** in 1985 totaled 108,113 units, an increase of 0.8% over the 107,218 electric unit heaters shipped in the previous year. **Electric infrared heater** shipments in 1985, at 17,125 units, were down 17.8% from the year-previous total of 20,836 units.



Shipments of **electric duct furnaces** in 1985, at 167,156 units, reflected a whopping 72.6% increase over the revised total of 96,841 electric duct furnaces shipped in 1984. No figures were reported for shipments of **electric baseboard**, except glass panel types, for 1985. However, in 1984, a total of 2,375,634 units were shipped. Shipments of **electric space heaters**, other than baseboard, in 1985 totaled 1,348,071 units, down 4.7% from the year-previous total of 1,414,033 units.

Oil burners

Oil burner installations in 1986 totaled 555,000 units, up 3.5% over the 536,000 installations made in 1985, according to Fuel Oil/Oil Heat magazine.

Of these, 95,000 were installed in new single-family homes, up 55.7% from the 61,000 oil-fired systems installed in new homes in 1985. New home installations totaled 85,000 in 1979.

The increases came almost wholly from oil's marketing strength in the Northeast. The strong housing market in that region over the past two years, coupled with a sharp reduction in fuel oil prices and relatively expensive natural gas and electricity in many areas, has led to a resurgence of oil heat installations.

For example, oil captured only 2.1% of the national new single-family home market in 1984. A year later it was 2.6% and, in 1986, oil accounted for 4.1% of single-family starts. In the multifamily sector, oil's share advanced from 0.2% to 1.3% over the past two years.

Virtually all of the increase has come in the Northeast where oil in 1986 captured 21.6% of the single-family home market and 11.6% of multifamily units. Nowhere else in the country did oil's share top 1%.

There were 214,000 **replacement oil burners** shipped in 1986, down 17% from the 258,000 replacement burners shipped in the previous year.

The magazine estimates that nearly all of these burners were retention-head or other high-efficiency burners that were used to replace less-efficient burners on a voluntary (simply to save fuel) or involuntary (breakdown) basis. In fact, it is becoming increasingly difficult to find older burner designs when needed.

Fuel Oil/Oil Heat estimates that 161,000 oil-fired boilers were installed in 1986, up 20.1% from the 134,000 oil boilers installed in the previous year. Similarly, the magazine estimated 180,000 oil-fired furnaces were installed last year, up 25% from the 144,000 oil furnaces installed in 1985.

Conversions to oil from other fuels in 1986 were estimated at 35,000, up 16.7% from the 30,000 conversions the magazine estimated were made in the previous year. Only 9,000 conversions were reported in 1984.

Most of these conversions were from

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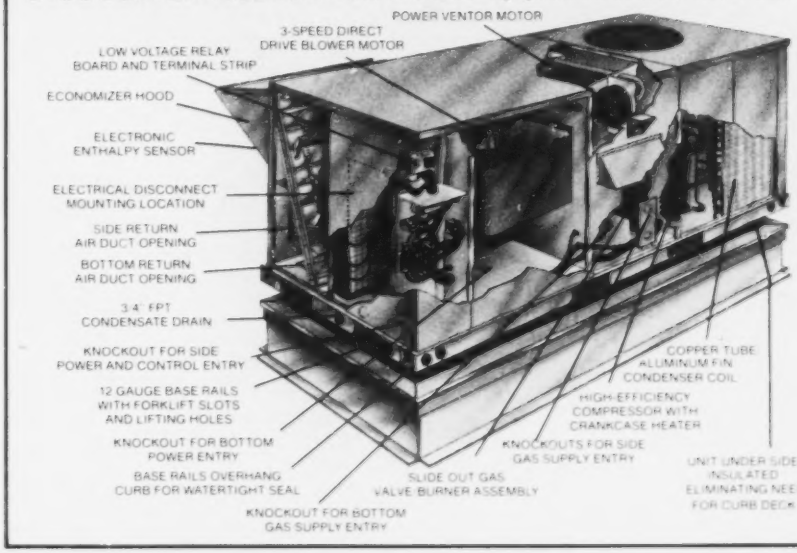
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electricity although, in regions where natural gas is expensive, a few have converted to oil. Conversions from oil to natural gas, which approached 300,000 in 1980, were not significant in 1986.

The Bureau of the Census reported that 24,719 **commercial and industrial oil burner units** were shipped in 1985, the latest year for which these figures were available. That represents a 9.7% decline from the 27,370 units shipped in the previous year.

Replacement oil burners for commercial and industrial applications in 1985 totaled 21,530 units, down 9.9% from the 23,903 replacement burners shipped in 1984. There was no breakdown for low- and high-pressure atomizing types. In past years they have been almost evenly split.

The Census Bureau reported shipments of **oil-fired floor and wall furnaces** in 1985 totaled 4,050 units, up 12.8% from the 3,590 units shipped in 1984.

The Bureau reported that, in 1985, a total of 446,646 **residential replacement oil burners** were shipped, down 1.9% from the 451,935 replacement burners shipped in the previous year.

Commercial boilers

The American Boiler Manufacturers Association (ABMA) forecast that the commercial boiler market in 1987 is expected to stay even with the 1986 total of 22.5 million pounds of steam per hour.

The forecast for industrial units, now smaller than the commercial segment of the market, is for 3% growth in 1987 to 18.6 million pounds of steam per hour. The 1986 total was 18 million pounds.

The fast-growing cogeneration market is in for a tumble this year, according to ABMA. The market, which demonstrated a 157% increase from 414 megawatts (MW) in 1984 to 1,067 MW last year, is expected to decline by 51.4% this year to a still-respectable 519 MW.

For the record, the utility boiler market is expected to more than double in 1987 on the strength of export orders, ABMA reported. Shipments in this market segment totaled 1,839 MW in 1986 and, this year, should grow to 3,850 MW.

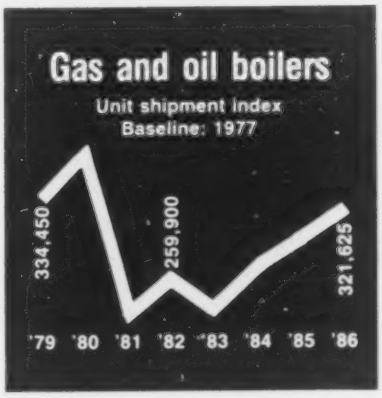
Other heating equipment

The Wood Heating Alliance (WHA) reported that, in 1985, a total of 590,900 wood stoves were shipped. This figure is technically 52% below the 1,235,600 total reported for 1984 but, in reality, the comparison is not accurate. LSI Systems, Inc., which conducts the study for WHA, discontinued counting used stoves in 1985.

Of the wood stove total, WHA estimates that 65,100 units, or 11% of the total, went into new homes and 525,800 units, or 89% of all wood stoves shipped, went into existing homes.

WHA estimates that, in 1985, a total of 1,489,900 fireplaces were installed, down 2.4% from the total of 1,526,100 fireplaces installed in the previous year. Of these, the 1,021,800 fireplaces (68.6% of the total) stayed even with the prior year while the 468,100 fireplaces (31.4% of the total) installed in existing homes declined 7.5% from the 505,800 units installed in 1984.

Shipments of fireplace inserts, at 484,100 units in 1985, were 36.1% lower than the 757,700 inserts shipped in the previous year, according to WHA.



Additional perspective on the total comfort space heating market is provided by the Bureau of the Census. The Bureau reported that in 1985, the latest year for which these data are available, a total of 1,026,977 **domestic heating stoves** were shipped, down 12.8% from the 1,177,122 heating stoves shipped in the previous year.

Of these:

- 174,565 were gas-fired, up marginally from the 174,059 total for 1984. This category includes radiant units as well as vented and unvented circulating types.
- 215,025 used other fuels, down 25% from the 286,976-unit total in 1984. The other fuels include kerosene, gasoline, fuel oil, and coal.
- The total for wood stoves, at 170,446 units in 1985, was down 24.4% from the 1984 total of 225,447 units shipped in the previous year.

Of this total, 73,982 (43.4%) were circulating types, down 20.5% from 93,054 units in the previous year; 44,724 (26.2%) were radiant types, down 25.4% from 59,965 units in 1984; and 51,740 (30.4%) were other types, down 28.6% from the prior-year total of 72,428 units.

- The total for other wood-burning appliances, at 637,387 in 1985, represented an 11% decline from the total of 716,087 appliances shipped in 1984.

Of this total, 66,504 were freestanding fireplaces, down 21.4% from 84,633 fireplaces in the previous year; 296,879 were zero-clearance fireplaces, up 4.6% from the 283,840-unit total in 1984; and 103,558 were fireplace inserts, down 15.2% from the prior-year total of 122,167 inserts.

Solar

The Bureau of the Census reported that shipments of solar collectors in 1985, the latest year for which figures are available, totaled 139,411 units. That represents an 18.5% decline from the 170,942-unit total for 1984.

Of the total shipped in 1985, low-temperature collectors designed to operate at temperatures below 110°F accounted for 40.6% or 56,624 units, down 15.3% from the 66,855-unit total for this category in the previous year.

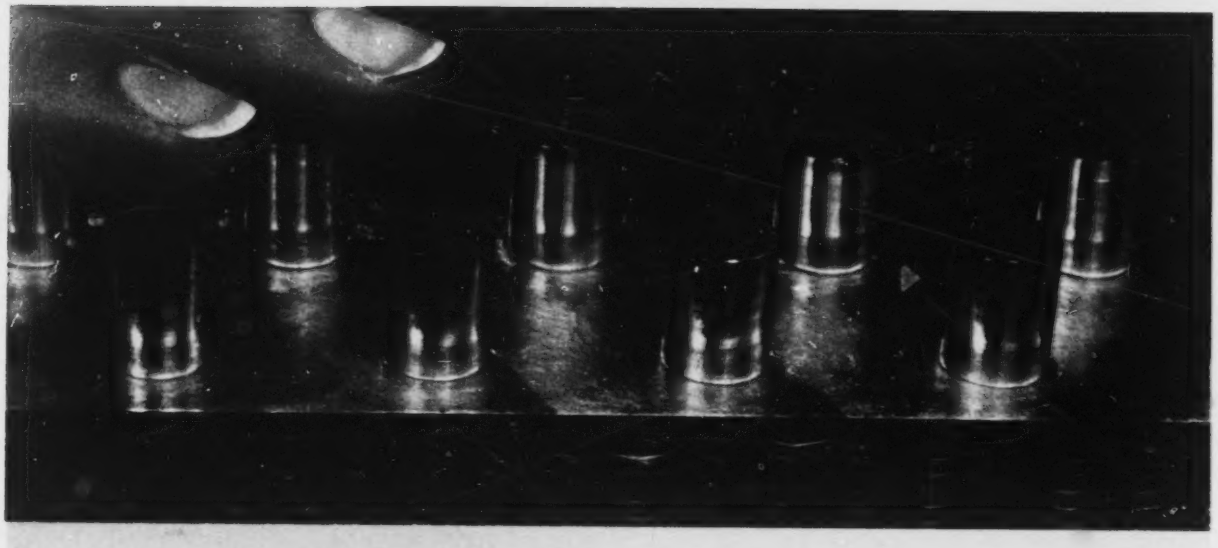
A total of 82,787 medium temperature collectors were shipped in 1985, down 20.4% from the 104,087 medium-temperature units shipped in 1984. The 1985 total represented 59.4% of all collectors shipped.

Of the medium-temperature collectors, 70,810 units (or 85.5%) were liquid collectors, down 22.9% from the prior-year total of 91,833 units; and 11,977 units (or 14.5% of the total) were air collectors, down 2.3% from the 12,254 air collectors shipped in 1984.

No figures are available for high-temperature collectors operating at temperatures above 180°F, including concentrating and evacuated-tube collectors, because they might disclose the shipments of individual companies.

The solar collector record, in units:

1978	170,611		
1979	226,659	up	33%
1980	303,102	up	34%
1981	254,768	down	16%
1982	201,217	down	21%
1983	175,080	down	13%
1984	170,942	down	2.4%
1985	139,411	down	19%



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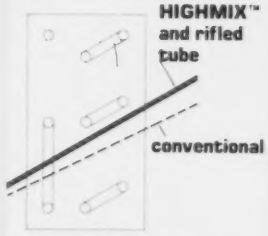

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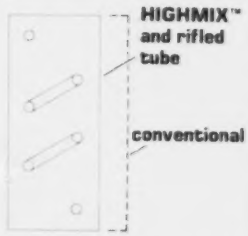

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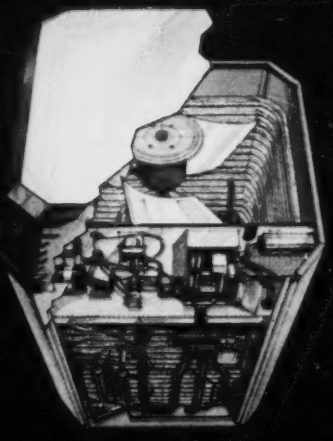

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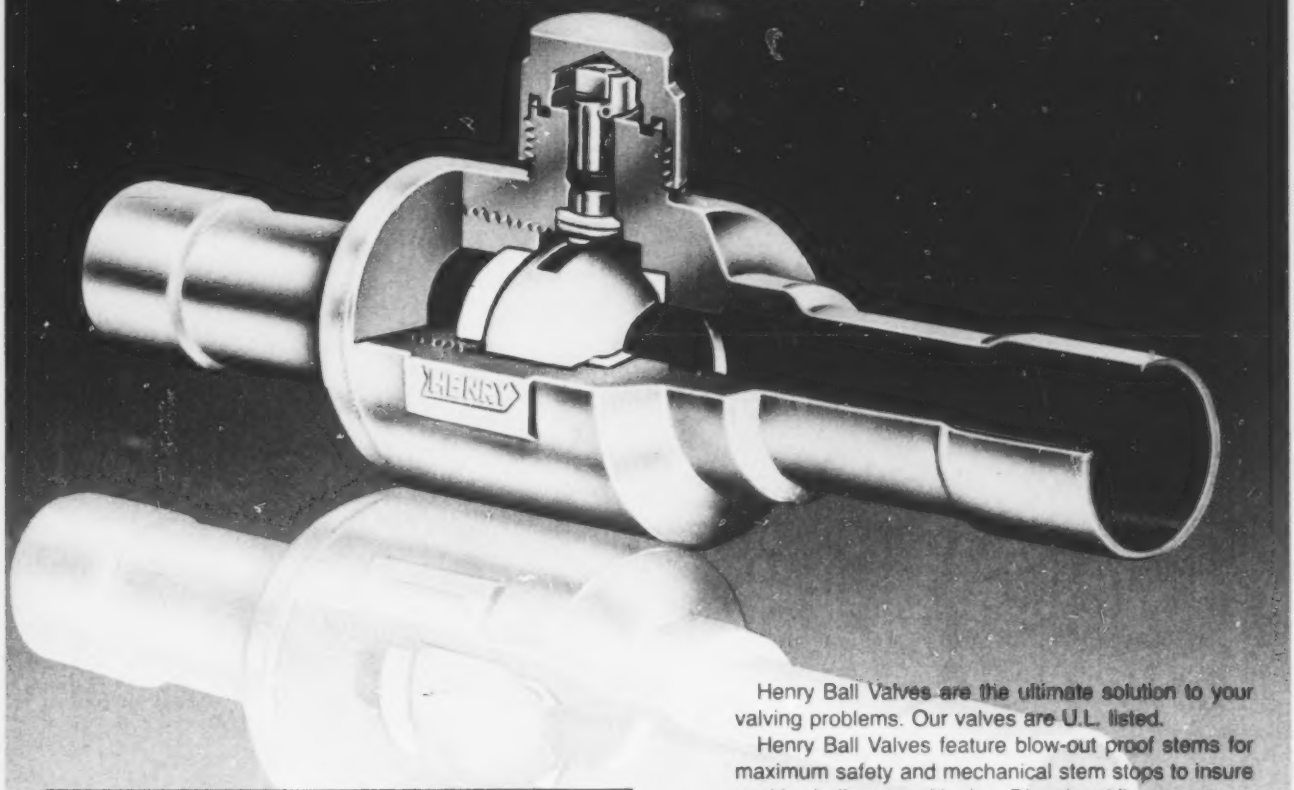

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Mechanical Directional Stem Stops	YES	Yes	Yes	No	No
Blow Out Proof Stem	YES	Yes	No	No	No
UL Listed	YES	Yes	Yes	No	No
Published Flow Data	YES	No	No	Yes	Yes
Brass Ball	YES	No	No	No	No
Optional Lever Handle	YES	No	No	No	No

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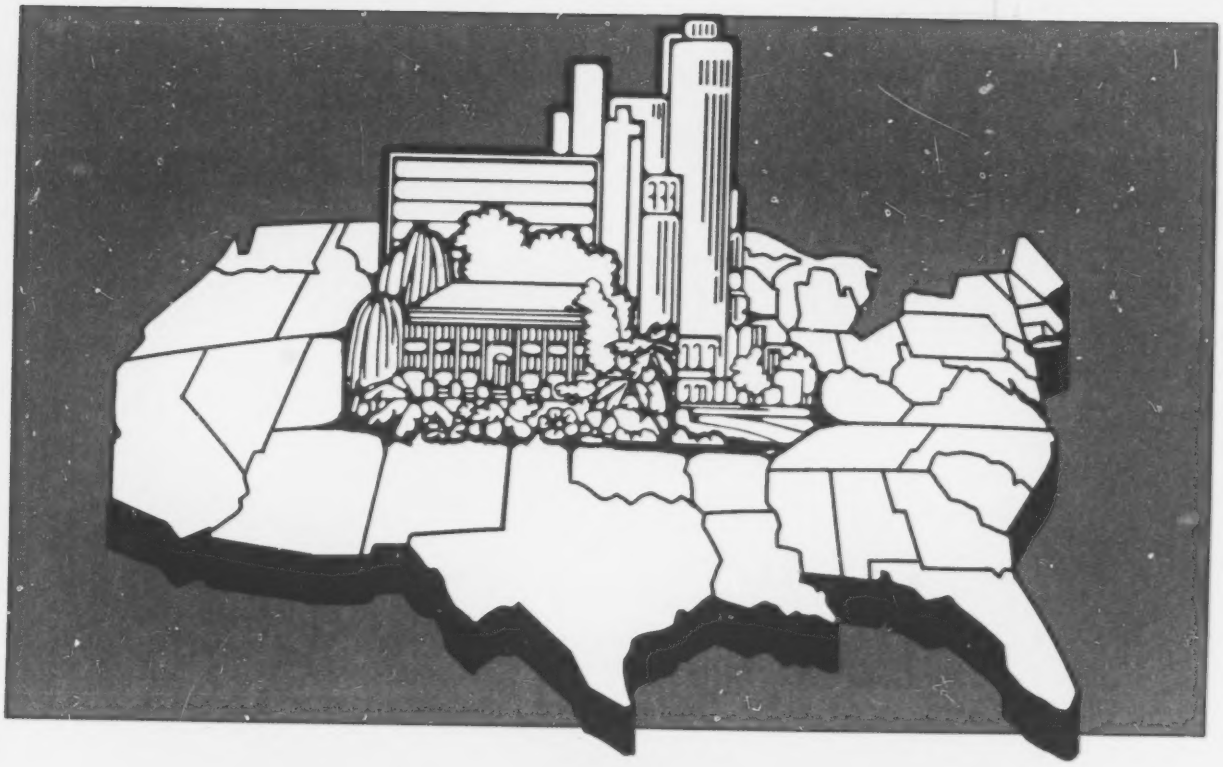


America's office market is overbuilt by 50% study says

Bad news for the hvac industry: America is severely glutted with office buildings. So concludes a joint study by the Massachusetts Institute of Technology (MIT) and Arthur Andersen & Co. Its main message is simple. In the past decade, office construction totaled just under 1.4 billion sq ft. In the next decade, we will need only half that volume.

On the following pages we present data from that study, which revolves around a constant theme: the continuing "overbuilding" that prevents cities from reaching a desired 6% vacancy rate. If the report is correct, some cities could go for eight years without any new office construction before reaching that 6% vacancy level. Among them are: Green Bay, Wis.; Chattanooga, Tenn.; Beaumont, Tex.; Salt Lake City, Utah; Reno, Nev.; and Stockton, Calif. The entire state of Hawaii needn't erect another office building until 1994.

Some regions are more overbuilt that others. The Middle Atlantic Region (New York, New Jersey, Pennsylvania) will continue to have a hearty appetite for office space, running at 96% of the past decade's output. But on the other coast, the picture (if accurate) is bleak. The Pacific Region (Alaska, California, Hawaii, Oregon, and Washington) will need only 27% of the office space built during 1975-1985. Some eastern cities, even those that built feverishly in 1975-1985, will continue to boom. Among them are Washington, New York City, Baltimore, and Boston. But the further west you look, the bleaker it gets. Cities like Phoenix, Los Angeles, and Houston are expected to remain surfeited for years to come.

The key factor is jobs. Most of the baby boomers have already moved into America's offices, and there won't be as many jobs created in the next decade. Past overbuilding was also stimulated by available capital, active foreign investment, inflationary escalation in rents, and tax laws that encouraged speculative building. Most of these factors have been severely diminished.

Result: subcontractors will be in for a rough ride. Some of the slack may be taken up by other sectors like educational and institutional buildings. Construction of health care facilities is solid, and many colleges are spending big bucks for sports arenas, laboratories, and service buildings. But the entrepreneurial spirit of many contractors will be severely tested in the decade ahead.

The full report, "America's Office Needs: 1985-1995," is available from Arthur Andersen & Co., 69 W. Washington St., Chicago, Ill. 60602.

Construction to 1995 if overbuilding continues at present levels

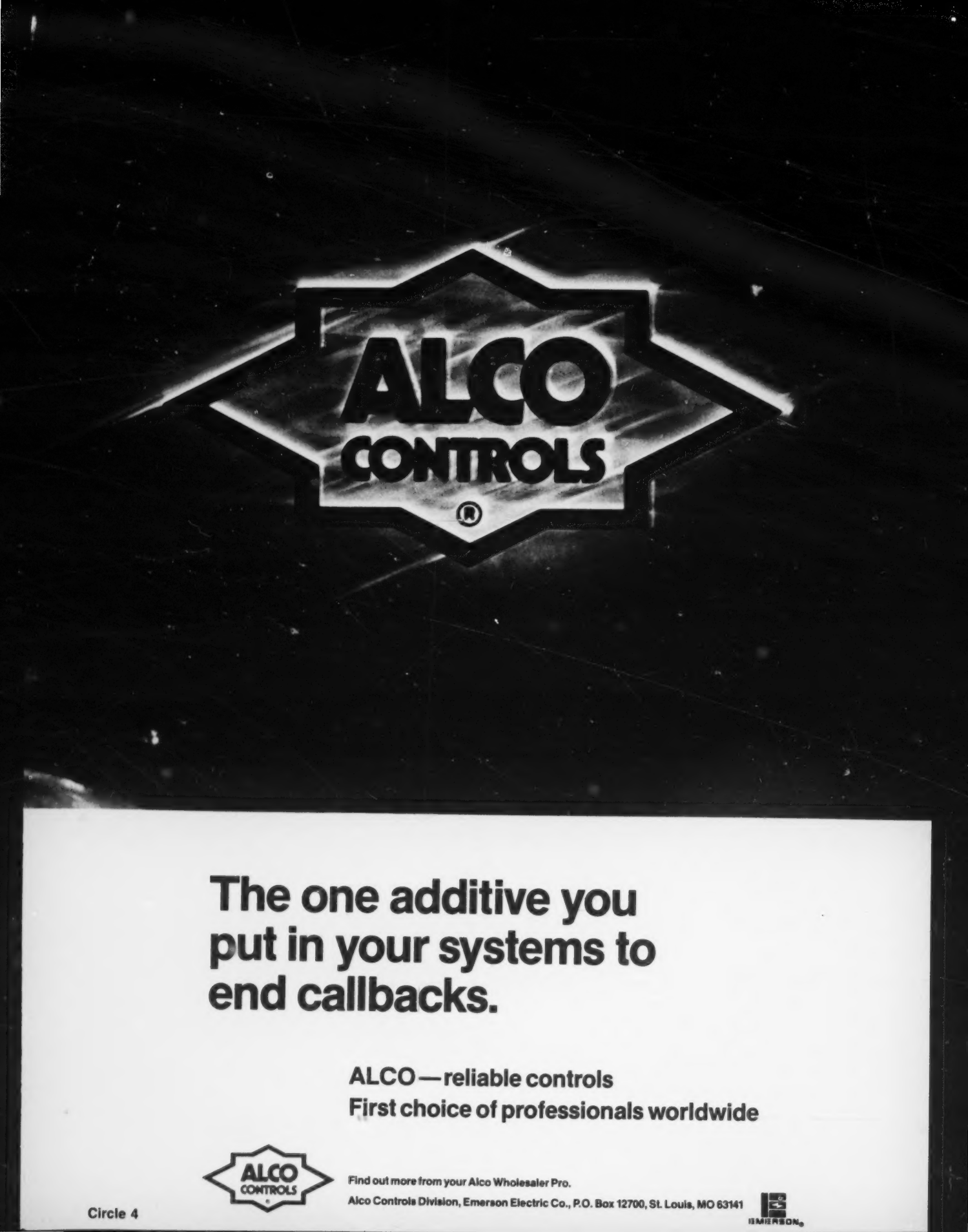
	Total space 1985	Primary office space by 1995 if overbuilding continues	Primary office space built 1985 to 1995 if overbuilding continues	Primary office space built 1975 to 1985	Projected 1995 vacancy rates if overbuilding continues
	(in millions of square feet)				
Alabama	40.3	52.3	11.9	12.2	26.5%
Alaska	6.2	8.6	2.4	2.8	23.0%
Arizona	52.9	99.0	46.1	33.8	43.3%
Arkansas	20.4	30.2	9.7	8.3	26.4%
California	509.2	767.9	258.7	265.1	23.0%
Colorado	59.3	87.2	27.9	29.6	28.3%
Connecticut	67.6	89.2	21.6	19.6	12.0%
Delaware	8.3	11.6	3.3	2.7	12.0%
District of Columbia	26.1	39.5	13.4	12.1	6.5%
Florida	179.1	261.4	82.4	77.8	22.3%
Georgia	85.7	124.5	38.9	34.1	21.3%
Hawaii	18.6	23.3	4.7	6.1	20.8%
Idaho	8.9	11.9	3.0	3.3	20.6%
Illinois	205.3	256.1	50.8	46.0	17.3%
Indiana	69.9	89.4	19.5	17.9	17.0%
Iowa	31.2	38.1	6.9	6.9	16.1%
Kansas	27.9	35.4	7.5	7.4	16.1%
Kentucky	32.8	43.5	10.8	9.7	20.0%
Louisiana	59.0	87.5	28.6	24.9	21.8%
Maine	11.6	15.2	3.6	4.3	12.8%
Maryland	72.2	102.6	30.3	27.4	8.4%
Massachusetts	126.7	167.7	41.0	46.9	12.5%
Michigan	109.5	140.3	30.9	22.9	16.2%
Minnesota	70.6	88.1	17.5	22.5	17.1%
Mississippi	20.3	26.4	6.1	5.7	20.2%
Missouri	69.5	87.3	17.8	20.1	16.5%

Construction to 1995 if overbuilding continues at present levels

	Total space 1985	Primary office space by 1995 if overbuilding continues	Primary office space built 1985 to 1995 if overbuilding continues	Primary office space built 1975 to 1985	Projected 1995 vacancy rates if overbuilding continues
	(in millions of square feet)				
Montana	6.9	9.4	2.6	2.7	21.1%
Nebraska	20.8	26.0	5.2	6.0	16.6%
Nevada	25.1	40.4	15.3	15.3	36.1%
New Hampshire	13.7	18.7	5.0	5.6	13.1%
New Jersey	168.3	222.9	54.5	40.9	12.1%
New Mexico	15.9	24.7	8.8	7.5	27.8%
New York	371.4	493.1	121.7	90.0	11.6%
North Carolina	80.2	105.8	25.6	25.9	21.0%
North Dakota	5.6	6.7	1.2	1.8	17.7%
Ohio	139.8	174.2	34.3	30.3	16.6%
Oklahoma	41.9	60.2	18.3	19.8	29.6%
Oregon	33.0	42.7	9.6	10.7	19.3%
Pennsylvania	171.1	223.4	52.3	42.2	14.1%
Rhode Island	15.9	19.8	4.0	5.2	12.7%
South Carolina	38.1	53.2	15.2	15.4	22.0%
South Dakota	5.5	7.0	1.5	1.5	16.2%
Tennessee	59.1	77.8	18.8	19.1	21.2%
Texas	278.6	448.1	169.5	150.8	30.9%
Utah	19.3	27.5	8.2	8.5	30.5%
Vermont	6.2	8.8	2.6	2.5	12.7%
Virginia	84.7	116.9	32.2	32.0	15.8%
Washington	59.4	79.8	20.4	22.8	21.0%
West Virginia	12.7	16.8	4.1	3.5	19.9%
Wisconsin	63.9	76.7	12.8	15.8	16.5%
Wyoming	4.4	6.7	2.3	2.4	23.6%

Primary office space needed to achieve 6% vacancy rate in 1995

	Total primary office space 1985	Total primary office space 1995	Needed construction 1985 - 1995	Construction 1975 - 1985	Change in amount of construction
	(in millions of square feet)				
Alabama	40.3	44.0	3.7	12.2	-8.5
Alaska	6.2	7.1	0.9	2.8	-1.9
Arizona	52.9	59.7	6.8	33.8	-27.0
Arkansas	20.4	23.6	3.2	8.3	-5.1
California	500.2	580.3	71.3	265.1	-193.8
Colorado	59.3	66.5	7.2	29.6	-22.4
Connecticut	67.6	83.5	15.8	19.6	-3.8
Delaware	8.3	10.8	2.5	2.7	-0.2
District of Columbia	26.1	39.3	13.2	12.1	1.1
Florida	179.1	216.0	37.0	77.8	-40.8
Georgia	85.7	104.2	18.6	34.1	-15.5
Hawaii	18.6	19.6	1.0	6.1	-5.1
Idaho	8.9	10.0	1.1	3.3	-2.2
Illinois	205.3	225.2	20.7	46.0	-25.3
Indiana	69.9	78.9	9.1	17.9	-8.8
Iowa	31.2	34.0	2.8	6.9	-4.1
Kansas	27.9	31.6	3.7	7.4	-3.7
Kentucky	32.8	37.1	4.3	9.7	-5.4
Louisiana	59.0	72.8	13.9	24.9	-11.0
Maine	11.6	14.1	2.5	4.3	-1.8
Maryland	72.2	99.9	27.6	27.4	0.2
Massachusetts	126.7	156.1	29.4	46.9	-17.5
Michigan	109.5	125.1	15.7	22.9	-7.2
Minnesota	70.6	77.7	7.3	22.6	-15.3
Mississippi	20.3	22.4	2.1	5.7	-3.6
Missouri	69.5	77.5	8.0	20.1	-12.1



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STATE CONSTRUCTION PATTERNS

Primary office space needed to achieve 6% vacancy rate in 1995

	Total primary office space 1985	Total primary office space 1995	Needed construction 1985 - 1995	Construction 1975 - 1985	Change in amount of construction
	(in millions of square feet)				
[illegible]	6.9	7.9	1.0	2.7	-1.7
Nebraska	20.8	23.1	2.3	6.0	-3.7
Nevada	25.1	27.5	2.4	15.3	-12.9
New Hampshire	13.7	17.3	3.5	5.6	-2.1
New Jersey	166.3	206.3	40.0	40.9	0.9
New Mexico	15.9	19.0	3.1	7.5	-4.4
New York	371.4	463.8	92.4	90.0	2.4
North Carolina	80.2	88.9	8.8	25.9	-17.1
North Dakota	5.6	5.9	0.3	1.8	-1.5
Ohio	139.8	154.5	14.7	30.2	-15.6
Oklahoma	41.9	45.1	3.2	19.8	-16.6
Oregon	33.0	36.6	3.6	10.7	-7.1
Pennsylvania	171.1	204.2	33.1	42.2	-9.1
Rhode Island	15.9	18.4	2.5	5.2	-2.7
South Carolina	38.1	44.2	6.1	15.4	-9.3
South Dakota	5.5	6.2	0.8	1.5	-0.7
Tennessee	59.1	65.2	6.3	19.1	-12.8
Texas	278.6	329.6	51.0	150.8	-99.8
Utah	19.3	20.3	1.0	8.5	-7.5
Vermont	6.2	8.2	2.0	2.5	-0.5
Virginia	84.7	104.7	20.0	32.0	-12.0
Washington	59.4	67.1	7.7	22.8	-15.1
West Virginia	12.7	14.3	1.7	3.5	-1.8
Wisconsin	63.9	68.2	4.3	15.8	-11.5
Wyoming	4.4	5.5	1.1	2.4	-1.3

Office space in primary office buildings in 1985 by market

	Amount of occupied primary office space	Amount of vacant primary office space	Total amount of primary office space	Amount of occupied other office space	Total amount of occupied office space
	(in millions of square feet)				
Alabama	32.6	7.7	40.3	114.5	147.1
Alaska	5.0	1.1	6.1	15.3	20.3
Arizona	36.5	16.3	52.8	103.3	139.8
Arkansas	15.6	4.8	20.4	67.6	83.2
California	395.8	113.4	509.2	887.9	1283.7
Colorado	46.1	13.2	59.3	117.8	163.9
Connecticut	59.8	7.8	67.6	128.8	188.6
Delaware	7.3	1.0	8.3	23.2	30.5
District of Columbia	24.4	0.7	25.1	40.1	64.5
Florida	144.7	34.4	179.1	363.9	508.6
Georgia	69.1	16.6	85.7	200.9	270.0
Hawaii	15.2	3.4	18.6	33.6	48.8
Idaho	7.3	1.6	8.9	26.5	33.8
Illinois	170.6	34.7	205.3	383.2	553.8
Indiana	58.4	11.5	69.9	179.9	238.3
Iowa	26.4	4.8	31.2	88.8	115.2
Kansas	23.6	4.3	27.9	81.8	105.4
Kentucky	26.6	6.2	32.8	105.4	132.0
Louisiana	47.6	11.3	58.9	128.7	176.3
Maine	10.3	1.3	11.6	37.3	47.6
Maryland	66.3	6.0	72.3	147.4	213.7
Massachusetts	112.3	14.4	126.7	240.7	353.0
Michigan	91.7	17.7	109.4	280.5	372.2
Minnesota	59.7	10.9	70.6	149.4	209.1
Mississippi	16.4	3.9	20.3	66.1	82.5
Missouri	58.8	10.7	69.5	179.6	238.4

Office space in primary office buildings in 1985 by market

	Amount of occupied primary office space	Amount of vacant primary office space	Total amount of primary office space	Amount of occupied other office space	Total amount of occupied office space
	(in millions of square feet)				
Montana	5.8	1.3	6.9	23.1	28.7
Nebraska	17.6	3.2	20.8	53.2	70.8
Nevada	18.8	6.3	25.1	30.1	48.9
New Hampshire	12.1	1.6	13.7	37.5	49.6
New Jersey	147.9	20.4	168.3	245.9	393.8
New Mexico	12.1	3.8	15.9	41.1	53.2
New York	328.3	43.1	371.4	607.6	935.9
North Carolina	64.8	15.4	80.2	207.8	272.6
North Dakota	4.7	0.9	5.6	20.8	25.5
Ohio	117.2	22.7	139.9	364.7	481.9
Oklahoma	31.9	10.0	41.9	99.5	131.4
Oregon	27.3	5.8	33.1	84.5	111.8
Pennsylvania	147.3	23.8	171.1	399.7	547.0
Rhode Island	14.0	1.8	15.8	34.8	48.8
South Carolina	30.8	7.3	38.1	100.2	131.0
South Dakota	4.6	0.8	5.4	20.8	25.4
Tennessee	47.7	11.3	59.0	153.2	200.9
Texas	211.9	66.8	278.7	545.8	757.7
Utah	14.5	4.8	19.3	53.0	67.5
Vermont	5.5	0.7	6.2	18.4	23.9
Virginia	72.1	12.6	84.7	183.9	256.0
Washington	48.5	10.9	59.4	139.0	187.5
West Virginia	10.2	2.4	12.6	51.8	62.0
Wisconsin	54.2	9.7	63.9	155.5	209.7
Wyoming	3.6	0.8	4.4	15.5	19.1

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Circle 26

New York, Philadelphia, Boston keep putting up new buildings

The New England states built 70 million sq ft of office space in the past decade — about 9% more than needed, according to the MIT-Arthur Andersen report. In that region, as in all others, "The existing (office building) stock has been obsolescing faster than its useful life . . ." In Boston, a major building erected in 1958 will be demolished to make way for a new one.

The Northeast region is less overbuilt than other areas, and some of its major cities remain dynamic. For instance, everything about the New York area suggests a mammoth building market. It has more than 400 million sq ft of office space, and will add another 570 million (and produce a vacancy rate of 11%) by 1995, at the current building pace.

Contractor Thomas Carty of Carty Heating in Manhattan sees office construction "going like crazy." But he questions whether there will be enough construction in the short term. "Every one of the contractors I know is finishing jobs now, but I don't know if they have jobs on the drawing board. My guess is that they do not."

Bill Canovan of the Building Trades Employers Association sees a "very hot" Manhattan market, with a lot of foreign money behind construction. Also, many builders strained to beat a recent city tax abatement deadline. "We've got a 15% vacancy rate now, and it's not going to go any lower. We've got a couple of Third Avenue buildings put up on spec with no tenants." New York has attracted a lot of out-of-town and foreign contractors, he says.

Sheet metal association executive John S. Brezovsky sees continued building in the seven counties that separate Manhattan and Albany. The region has become a magnet for many corporations' headquarters, stimulating construction of satellite service buildings.

Long Island threatens to sink under the weight of new construction — hotels, industrial parks, office buildings. A new wrinkle is condominiums for professional, commercial, and industrial ventures. Here, the business buys equity in the building instead of renting.

The Philadelphia market has been unspectacularly strong for the past few years, according to James Kelly, another sheet metal association executive. "It's up, it's good, it's strong," he says. Manhours worked for the unionized sheet metal sector have totaled 3 million for the past two years. But it may slow down in a few months. "With the tax reform and the volume of office space we've got, there won't be as much work as many contractors think."

Are contractors in Philly making suitable profits on the big volume of work going on? Not according to Joe Hartman of the William J. Donovan Co. "A lot of us are just trading dollars," he says. "We've seen one contractor after another going out of business." He recites a litany of common contractor complaints: slow pay, no pay, cutthroat bidding. "Ten years ago, there was a certain air of desperation about bidding. That air is still there, even though there is plenty of volume," he says. One alternative he is half-considering: paring down from a 100-person business to "the best damned 25-man outfit you ever saw."

Boston continues to build on its decade-long high-tech thrust. "From what I see, most of the contractors around here are pretty busy — electricians, plumbers, hvac," says Roy Pierce, Pierce Refrigeration. Boston's waterfront has seen much construction, as has its outer suburbs. It is forecast to add 125 million sq ft of office space in the next decade, about 15% more than it will need and putting its vacancy rate at 12% by 1995.

Long Island threatens to sink under the weight of new construction — hotels, industrial parks, office buildings. A new wrinkle is condominiums for professional, commercial, and industrial ventures. Here, the business buys equity in the building instead of renting.

Construction to 1995 if overbuilding continues at present levels

	Total space 1985	Primary office space by 1995 if overbuilding continues	Primary office space built 1985 to 1995 if overbuilding continues	Primary office space built 1975 to 1985	Projected 1995 vacancy rates if overbuilding continues
	(in millions of square feet)				
Rural Maine	5.1	6.4	1.2	1.7	12.7%
Portland, Me.	6.5	8.9	2.4	2.6	12.8%
Portsmouth-Rochester, N.H.	2.8	4.1	1.3	1.4	13.5%
Manchester-Nashua, N.H.	6.7	9.1	2.4	3.1	13.6%
Rural New Hampshire	4.2	5.5	1.2	1.1	11.9%
State of Vermont	6.2	8.8	2.6	2.5	12.7%
Pittsfield, Mass.	2.0	2.9	0.9	0.4	10.9%
Springfield, Mass.	8.9	11.6	2.7	2.6	12.0%
Worcester, Mass.	10.3	13.0	2.7	3.5	12.8%
Boston, Mass.	95.1	125.6	30.5	36.5	12.5%
Southeastern Massachusetts	5.4	8.2	2.7	2.9	13.9%
New Bedford-Fall River, Mass.	5.0	6.4	1.4	1.0	11.4%
State of Rhode Island	15.9	19.8	4.0	5.2	12.7%
New London-Norwich, Conn.	3.9	5.7	1.8	1.6	12.5%
New Haven-Waterbury, Conn.	12.1	15.9	3.8	2.2	11.2%
Bridgeport-Norwalk, Conn.	21.4	29.6	8.2	7.8	12.4%
Hartford, Conn.	30.2	38.0	7.8	7.9	12.0%
Albany-Schenectady-Troy, N.Y.	12.3	17.2	4.8	4.5	12.3%
Adirondack Region, N.Y.	3.3	4.5	1.2	0.6	11.0%
Utica-Rome, N.Y.	3.0	3.8	0.9	0.6	11.4%
Syracuse, N.Y.	11.0	15.4	4.4	3.2	11.8%
Rochester, N.Y.	15.9	20.8	4.9	4.2	11.8%
Buffalo, N.Y.	16.5	21.5	4.9	3.6	11.5%
Finger Lakes Region, N.Y.	5.6	7.5	1.8	0.8	10.9%
Binghampton-Elmira, N.Y.	3.8	5.1	1.3	0.9	11.5%
Catskill-Southeastern New York	7.4	9.7	2.3	2.3	12.2%
New York, N.Y.-New Jersey	429.2	568.8	139.6	101.8	11.5%
Atlantic City, N.J.	6.2	8.6	2.4	1.9	11.9%
Philadelphia, Pa.-New Jersey	102.4	133.2	30.7	26.5	15.8%
Lancaster, Pa.	4.6	6.3	1.7	1.7	12.4%
York, Pa.	3.8	5.1	1.3	0.9	11.4%
Harrisburg, Pa.	8.6	11.6	3.0	2.5	11.9%
Reading, Pa.	4.8	6.1	1.4	0.9	11.4%
Allentown-Bethlehem, Pa.-N.J.	8.6	11.4	2.7	1.5	11.1%
Scranton-Hazelton, Pa.	7.6	9.9	2.3	1.7	11.6%
Appalachia-Rural East Pa.	5.9	7.1	1.2	0.8	11.4%
Johnstown-Altoona, Pa.	3.9	5.3	1.3	1.0	11.5%
Pittsburgh, Pa.	35.4	46.4	11.0	9.8	14.6%
Rural Northwest, Pa.	6.7	8.9	2.1	0.8	10.8%
Erie, Pa.	3.2	4.2	1.0	0.5	11.0%

Primary office space needed to achieve 6% vacancy rate in 1995

	Total primary office space 1985	Total primary office space 1995	Needed construction 1985 - 1995	Construction 1975 - 1985	Change in amount of construction
	(in millions of square feet)				
Rural Maine	5.1	5.9	0.8	1.7	-0.9
Portland, Me.	6.5	8.2	1.7	2.6	-0.9
Portsmouth-Rochester, N.H.	2.8	3.7	1.0	1.4	-0.4
Manchester-Nashua, N.H.	6.7	8.4	1.7	3.1	-1.4
Rural New Hampshire	4.2	5.1	0.9	1.1	-0.2
State of Vermont	6.2	8.2	2.0	2.5	-0.6
Pittsfield, Mass.	2.0	2.7	0.7	0.4	-0.3
Springfield, Mass.	8.9	10.9	2.0	2.6	-0.6
Worcester, Mass.	10.3	12.0	1.8	3.5	-1.8
Boston, Mass.	95.1	116.9	21.8	36.5	-14.7
Southeastern Massachusetts	5.4	7.5	2.0	2.9	-0.8
New Bedford-Fall River, Mass.	5.0	6.1	1.0	1.0	0.0
State of Rhode Island	15.9	18.4	2.5	5.2	-2.7
New London-Norwich, Conn.	3.9	5.3	1.4	1.6	-0.2
New Haven-Waterbury, Conn.	12.1	15.1	2.9	2.2	-0.7
Bridgeport-Norwalk, Conn.	21.4	27.5	6.2	7.8	-1.7
Hartford, Conn.	30.2	35.6	5.4	7.9	-2.6
Albany-Schenectady-Troy, N.Y.	12.3	16.0	3.7	4.5	-0.8
Adirondack Region, N.Y.	3.3	4.2	1.0	0.6	0.3
Utica-Rome, N.Y.	3.0	3.6	0.6	0.6	0.1
Syracuse, N.Y.	11.0	14.5	3.4	3.2	-0.3
Rochester, N.Y.	15.9	19.5	3.6	4.2	-0.6
Buffalo, N.Y.	16.5	20.2	3.7	3.6	0.1
Finger Lakes Region, N.Y.	5.6	7.1	1.4	0.8	0.7
Binghampton-Elmira, N.Y.	4.8	4.8	1.0	0.9	0.1
Catskill-Southeastern New York	7.4	9.0	1.7	2.3	-0.6
New York, N.Y.-New Jersey	429.2	535.3	106.1	101.8	4.2
Atlantic City, N.J.	6.2	8.1	1.9	1.9	-0.1
Philadelphia, Pa.-New Jersey	102.4	119.3	16.9	26.5	-9.6
Lancaster, Pa.	4.6	5.9	1.3	1.7	-0.4
York, Pa.	3.8	4.8	1.0	0.9	0.2
Harrisburg, Pa.	8.6	10.9	2.3	2.5	-0.3
Reading, Pa.	4.8	5.8	1.0	0.9	-0.1
Allentown-Bethlehem, Pa.-N.J.	8.6	10.8	2.1	1.5	0.7
Scranton-Hazelton, Pa.	7.6	9.3	1.7	1.7	0.0
Appalachia-Rural East Pa.	5.9	6.7	0.8	0.8	0.0
Johnstown-Altoona, Pa.	3.9	5.0	1.0	1.0	0.0
Pittsburgh, Pa.	35.4	42.1	6.7	9.8	-3.1
Rural Northwest, Pa.	6.7	8.4	1.7	0.8	0.9
Erie, Pa.	3.2	4.0	0.8	0.5	0.3

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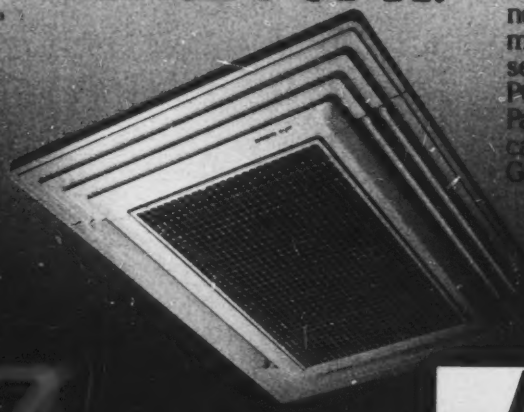

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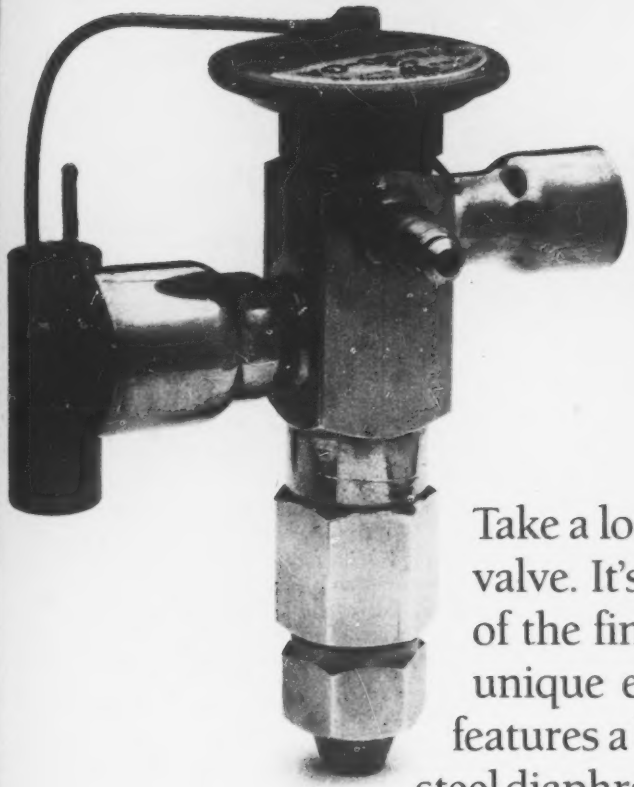
Circle 14

Office space in primary office buildings in 1985 by market

	Amount of occupied primary office space	Amount of vacant primary office space	Total amount of primary office space	Amount of occupied other office space	Total amount of occupied office space
	(in millions of square feet)				
Rural Maine	4.5	0.6	5.1	19.3	23.9
Portland, Me.	5.7	0.8	6.5	17.9	23.7
Portsmouth-Rochester, N.H.	2.4	0.3	2.8	10.5	12.9
Manchester-Nashua, N.H.	6.0	0.8	6.7	13.4	19.4
Rural New Hampshire	3.7	0.5	4.2	13.6	17.3
State of Vermont	5.5	0.7	6.2	18.4	23.8
Pittsfield, Mass.	1.8	0.2	2.0	7.8	9.6
Springfield, Mass.	7.9	1.0	8.9	20.8	28.7
Worcester, Mass.	9.1	1.2	10.3	23.4	32.4
Boston, Mass.	84.3	10.7	95.1	153.8	238.2
Southeastern Massachusetts	4.8	0.6	5.4	17.9	22.7
New Bedford-Fall River, Mass.	4.5	0.6	5.0	17.0	21.4
State of Rhode Island	14.0	1.8	15.9	34.8	48.8
New London-Norwich, Conn.	3.5	0.5	3.9	11.1	14.5
New Haven-Waterbury, Conn.	10.7	1.4	12.1	29.7	40.4
Bridgeport-Norwalk, Conn.	18.9	2.5	21.4	36.5	55.4
Hartford, Conn.	26.7	3.5	30.2	51.4	78.1
Albany-Schenectady-Troy, N.Y.	10.9	1.4	12.3	28.0	38.9
Adirondack Region, N.Y.	2.9	0.4	3.3	14.7	17.6
Utica-Rome, N.Y.	2.6	0.3	3.0	9.7	12.3
Syracuse, N.Y.	9.8	1.3	11.0	23.0	32.8
Rochester, N.Y.	14.0	1.8	15.9	39.5	53.5
Buffalo, N.Y.	14.6	1.9	16.5	41.7	56.3
Finger Lakes Region, N.Y.	5.0	0.7	5.6	21.6	26.5
Binghamton-Elmira, N.Y.	3.4	0.4	3.8	14.0	17.4
Catskill-Southeastern New York	6.5	0.9	7.4	20.7	27.2
New York, N.Y.-New Jersey	379.4	49.8	429.2	579.3	958.7
Atlantic City, N.J.	5.5	0.7	6.2	14.6	20.1
Philadelphia, Pa.-New Jersey	86.6	15.8	102.4	183.6	270.2
Lancaster, Pa.	4.1	0.5	4.6	14.7	18.8
York, Pa.	3.3	0.4	3.8	13.6	16.9
Harrisburg, Pa.	7.6	1.0	8.6	21.1	29.8
Reading, Pa.	4.2	0.6	4.8	11.6	15.8
Allentown-Bethlehem, Pa.-N.J.	7.6	1.0	8.6	22.3	30.0
Scranton-Hazelton, Pa.	6.8	0.9	7.6	22.4	29.2
Appalachia-Rural East Pa.	5.3	0.7	5.9	25.3	30.5
Johnstown-Altoona, Pa.	3.5	0.5	3.9	13.8	17.3
Pittsburgh, Pa.	30.4	5.0	35.4	77.5	107.9
Rural Northwest, Pa.	5.9	0.8	6.7	29.4	35.3
Erie, Pa.	2.9	0.4	3.2	9.5	12.3



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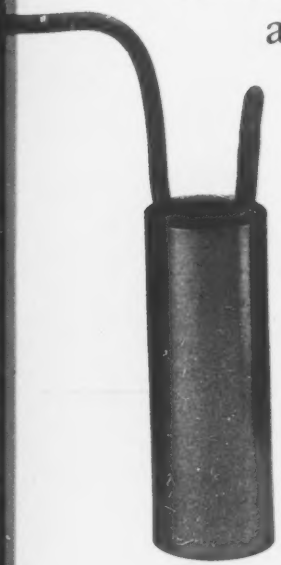

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Circle 49

Some 'rustbelt' cities show recovery in office building

Iowa may be an agriculturally depressed state, but there are islands of building activity. Des Moines, for example. Its market for new office construction has been strong for the past three years, says contractor Robert L. Lautenbach, Corn States Metal Fabricators, Inc.

Des Moines is home for some big insurance and printing companies, with no direct ties to the farm economy. Office construction has slowed down considerably in the first quarter of 1987, but there has been a lot of development. "There are still some offices under construction, but everybody wonders what's going to happen after they are built," Lautenbach says. "It's very hard to see beyond the next 12 months. We're not seeing much to bid on now." The retrofit market has been worked over pretty good, he thinks. "We've had so much demolition of the old stuff, so I don't see much out there."

Another city usually associated with a recession economy is Detroit, which has enjoyed something of a building boom in the past year. Many of its outer suburbs have blossomed with new offices, hotels, industrial projects, and service buildings.

Hvac contractor Robert Mead operates in a "very competitive market with very tight pricing, but with plenty of work left over." He now has four jobs on

Construction to 1995 if overbuilding continues at present levels

	Total space 1985	Primary office space by 1995 if overbuilding continues	Primary office space built 1985 to 1995 if overbuilding continues	Primary office space built 1975 to 1985	Projected 1995 vacancy rates if overbuilding continues
	(in millions of square feet)				
State of North Dakota	5.6	6.7	1.2	1.6	17.7%
State of South Dakota	5.5	7.0	1.5	1.5	16.2%
Northwestern Iowa	5.5	7.0	1.5	1.0	15.1%
Cedar Rapids-Iowa City, Iowa	3.2	4.5	1.3	1.1	16.0%
Des Moines, Iowa	10.8	13.1	2.3	3.5	17.4%
Southeastern Iowa	8.5	9.5	1.0	0.7	15.1%
Omaha, Neb.-Iowa	13.1	16.1	3.0	3.5	16.5%
Lincoln, Neb.	4.0	5.1	1.1	1.4	17.3%
Eastern Nebraska	2.3	3.0	0.7	0.6	15.8%
Western Nebraska	2.6	3.1	0.6	0.7	16.7%
Western Kansas	2.1	2.6	0.5	0.5	16.1%
Wichita, Kan.	7.2	9.3	2.1	1.9	15.9%
Eastern Kansas	6.0	7.4	1.4	1.2	15.5%
Topeka, Kan.	3.5	4.3	0.8	1.2	17.8%
Kansas City, Mo.-Kansas	27.7	35.8	8.1	7.7	16.1%
Northern Rural Missouri	7.0	8.7	1.7	2.4	17.4%
St. Louis, Mo.-Illinois	42.4	52.6	10.2	12.4	16.7%
Springfield, Mo.	2.7	3.7	1.0	0.9	16.2%
Southern Rural Missouri	5.3	6.3	1.0	1.3	16.4%
Huntington, W.Va.	2.4	3.3	0.8	0.5	18.7%

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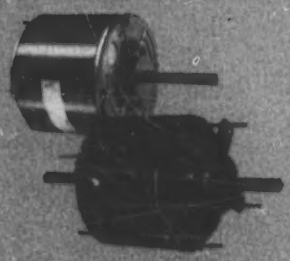

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Circle 19

Construction to 1995 if overbuilding continues at present levels

	Total space 1985	Primary office space by 1995 if overbuilding continues	Primary office space built 1985 to 1995 if overbuilding continues	Primary office space built 1975 to 1985	Projected 1995 vacancy rates if overbuilding continues
	(in millions of square feet)				
Southeastern Ohio	6.3	7.2	0.9	1.1	16.8%
Youngstown-Warren, Ohio	5.4	6.9	1.5	0.5	14.9%
Cleveland-Akron, Ohio	42.6	49.3	6.7	5.7	16.2%
Canton, Ohio	4.0	4.9	0.9	0.2	14.7%
Columbus, Ohio	24.5	31.8	7.3	8.3	17.9%
Dayton-Springfield, Ohio	13.0	17.1	4.1	3.7	16.8%
Cincinnati, Ohio-Ky.-Ind.	24.6	32.5	7.9	7.1	16.9%
Northwestern Rural Ohio	15.1	18.5	3.4	3.2	16.6%
Toledo, Ohio	7.5	10.1	2.6	1.4	15.3%
Detroit, Mich.	66.1	84.6	18.5	10.3	15.4%
Flint, Mich.	4.3	5.8	1.5	2.0	20.3%
Saginaw-Bay City, Mich.	4.2	5.8	1.6	1.2	16.4%
Lansing-Jackson, Mich.	7.8	10.0	2.3	2.0	16.7%
Battle Creek-Kalamazoo, Mich.	5.3	6.5	1.1	1.1	16.6%
Grand Rapids-Muskegon, Mich.	10.4	13.2	2.8	3.0	17.3%
Northern Rural Michigan	4.7	5.9	1.1	1.3	17.2%
Southern Rural Michigan	4.9	6.5	1.6	1.7	17.6%
South Bend, Ind.	7.8	9.9	2.1	1.4	15.8%
Fort Wayne, Ind.	6.1	8.1	2.0	1.9	17.2%
Indianapolis, Ind.	22.5	29.8	7.3	6.7	17.0%
Northern Rural Indiana	15.6	19.0	3.4	3.4	16.7%
Southern Rural Indiana	2.9	3.5	0.6	0.7	17.0%
Evansville, Ind.-Kentucky	4.3	5.4	1.2	1.3	17.4%
Southern Rural Illinois	1.6	1.8	0.2	0.0	15.3%
Northern, Central Illinois	8.6	9.1	0.5	0.5	16.2%
Springfield-Decatur, Ill.	4.8	5.5	0.7	0.0	14.9%
Bloomington-Champaign, Ill.	5.3	5.8	0.5	1.6	19.4%
Peoria, Ill.	5.0	5.8	0.8	0.4	15.6%
Davenport-Moline, Ill.-Iowa	4.4	5.5	1.1	0.8	16.1%
Chicago, Ill.-Indiana	178.5	226.7	48.2	43.3	17.5%
Rockford, Ill.	4.3	5.2	0.9	0.7	16.0%
Milwaukee-Racine, Wisc.	31.9	38.8	6.9	6.0	15.1%
Madison, Wisc.	7.6	9.7	2.1	3.9	21.1%
Green Bay-Appleton, Wisc.	7.2	8.3	1.1	1.9	17.1%
Southern, Central Wisconsin	15.2	17.8	2.6	3.8	16.7%
Northern Rural Wisconsin	1.8	2.0	0.2	0.2	15.7%
Duluth, Minn.-Wisconsin	1.5	1.7	0.1	-0.1	14.0%
Northern Rural Minnesota	2.2	2.5	0.3	10.6	17.5%
Minneapolis-St. Paul, Minn.	57.9	73.9	16.0	19.7	17.2%
Southern Rural Minnesota	9.2	10.3	1.0	2.2	17.1%

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NORTH CENTRAL

Primary office space needed to achieve 6% vacancy rate in 1995

	Total primary office space 1985	Total primary office space 1995	Needed construction 1985 - 1995	Construction 1975 - 1985	Change in amount of construction
	(in millions of square feet)				
Southeastern Ohio	0.3	0.4	0.1	1.1	-1.0
Youngstown-Warren, Ohio	5.4	6.2	0.9	0.5	0.3
Cleveland-Akron, Ohio	42.6	43.9	1.4	5.7	-4.4
Canton, Ohio	4.0	4.4	0.5	0.2	0.3
Columbus, Ohio	24.5	27.8	3.3	8.3	-5.0
Dayton-Springfield, Ohio	13.0	15.1	2.1	3.7	-1.5
Cincinnati, Ohio-Ky.-Ind.	24.6	28.7	4.2	7.1	-3.0
Northwestern Rural Ohio	15.1	16.4	1.3	3.2	-1.9
Toledo, Ohio	7.5	9.1	1.6	1.4	0.2
Detroit, Mich.	66.1	76.1	10.0	10.3	-0.3
Flint, Mich.	4.3	4.9	0.6	2.0	-1.5
Saginaw-Bay City, Mich.	4.2	5.1	0.9	1.2	-0.3
Lansing-Jackson, Mich.	7.8	8.9	1.1	2.0	-0.9
Battle Creek-Kalamazoo, Mich.	5.3	5.7	0.4	1.1	-0.7
Grand Rapids-Muskegon, Mich.	10.4	11.6	1.2	3.0	-1.8
Northern Rural Michigan	4.7	5.2	0.4	1.3	-0.8
Southern Rural Michigan	4.9	5.7	0.8	1.7	-0.9
South Bend, Ind.	7.8	8.9	1.1	1.4	-0.4
Fort Wayne, Ind.	6.1	7.2	1.0	1.9	-0.9
Indianapolis, Ind.	22.5	26.3	3.9	6.7	-2.9
Northern Rural Indiana	15.6	16.8	1.2	3.4	-2.1
Southern Rural Indiana	2.9	3.1	0.2	0.7	-0.5
Evansville, Ind.-Kentucky	4.3	4.8	0.5	1.3	-0.8
Southern Rural Illinois	1.6	1.6	0.0	0.0	-0.0
Northern Central Illinois	8.6	8.6	0.0	0.5	-0.5
Springfield-Decatur, Ill.	4.8	5.0	0.2	0.0	-0.2
Bloomington-Champaign, Ill.	5.3	5.0	0.0	1.6	-1.6
Peoria, Ill.	5.0	5.2	0.2	0.4	-0.2
Davenport-Moline, Ill.-Iowa	4.4	4.9	0.5	0.8	-0.3
Chicago, Ill.-Indiana	178.5	198.9	20.4	43.3	22.9
Rockford, Ill.	4.3	4.6	0.3	0.7	-0.3
Milwaukee-Racine, Wisc.	31.9	35.0	3.1	6.0	-2.9
Madison, Wisc.	7.6	8.1	0.5	3.9	-3.3
Green Bay-Appleton, Wisc.	7.2	7.3	0.1	1.9	-1.8
Southern Central Wisconsin	15.2	15.8	0.6	3.8	-3.2
Northern Rural Wisconsin	1.8	1.8	0.0	0.2	-0.2
Duluth, Minn.-Wisconsin	1.5	1.5	0.0	0.0	-0.0
Northern Rural Minnesota	2.2	2.2	0.0	0.6	-0.6
Minneapolis-St. Paul, Minn.	57.9	65.1	7.2	19.7	-12.5
Southern Rural Minnesota	9.2	9.0	0.0	2.2	-2.2

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the boards, having completed eight sizeable jobs last year. He calls Detroit's rebound "absolutely astounding. It was so far behind, and now it's playing catch-up." It costs less to build in the Motor City market, he believes. "You're seeing buildings going up here for $15 to $18 per square foot compared to $80 in New York City and $50 in Connecticut."

Mead thinks office construction has a "multiplier effect." "It seems that where office buildings go in, other buildings follow: hotels, retail stores, strip shopping centers, and medical clinics." Much of Detroit's renaissance is due to the acquisition of Electronic Data Systems (EDS) by General Motors Corp. This has stimulated a modest housing boom and has driven up real estate prices. The new I-275 interstate expressway has been the focus of much of the new building. Detroit Edison's long-range plan forecasts continued growth in the area.

Chicago continues to change its skyline profile almost yearly. Space may go begging in some buildings, but the new Prudential Plaza, a 64-story office tower, has tenants all signed up for more than 10% of its 940,000 sq ft, and another 140,000 sq ft is also spoken for. Some non-office construction has also pumped money into the contracting stream. The recently completed 530,000-sq-ft addition to McCormick Place was a mammoth undertaking. The new United Airlines terminal at O'Hare will add another $1.4 billion to the economy. Chicago is in the middle of a three-year building surge, says contractor V.J. Comforte, a big sheet metal firm.

Illinois is expected to gain nearly half a million jobs in the next decade, nearly double the rate of the past ten years. This means that Chicago, which now has 179 million sq ft of office space, may gain as much as 48 million sq ft if the present building pace continues.

St. Louis may soon reach a point where the office market turns down, but there is still "an awful lot of office space being built," says Robert Eckart of Central Air Systems. He points to a lot of automotive work, especially from Chrysler and General Motors plants. Another big employer doing well is McDonald Douglas Corp., whose defense payroll is a

Primary office space needed to achieve 6% vacancy rate in 1995

	Total primary office space 1985	Total primary office space 1995	Needed construction 1985 - 1995	Construction 1975 - 1985	Change in amount of construction
	(in millions of square feet)				
State of North Dakota	5.5	5.9	0.3	1.8	-1.5
State of South Dakota	5.5	6.2	0.8	1.5	-0.8
Northwestern Iowa	5.5	6.3	0.8	1.0	-0.2
Cedar Rapids-Iowa City, Iowa	3.2	4.0	0.9	1.1	-0.2
Des Moines, Iowa	10.8	11.5	0.7	3.5	-2.7
Southeastern Iowa	8.5	8.6	0.1	0.7	-0.6
Omaha, Neb.-Iowa	13.1	14.3	1.2	3.5	-2.3
Lincoln, Neb.	4.0	4.5	0.5	1.4	-0.9
Eastern Nebraska	2.3	2.7	0.4	0.6	-0.2
Western Nebraska	2.6	2.8	0.2	0.7	-0.5
Western Kansas	2.1	2.3	0.2	0.5	-0.3
Wichita, Kan.	7.2	8.3	1.1	1.9	-0.8
Eastern Kansas	6.0	6.7	0.7	1.2	-0.5
Topeka, Kan.	3.5	3.7	0.3	1.2	-1.0
Kansas City, Mo.-Kansas	27.7	32.0	4.3	7.7	-3.4
Northern Rural Missouri	7.0	7.7	0.7	2.4	-1.7
St. Louis, Mo.-Illinois	42.4	46.6	4.2	12.4	-8.2
Springfield, Mo.	2.7	3.3	0.6	0.9	-0.3
Southern Rural Missouri	5.3	5.6	0.3	1.3	-1.0
Huntington, W.Va.	2.4	2.8	0.4	0.5	-0.1

Office space in primary office buildings in 1985 by market

	Amount of occupied primary office space	Amount of vacant primary office space	Total amount of primary office space	Amount of occupied other office space	Total amount of occupied office space
	(in millions of square feet)				
Southeastern Ohio	5.3	1.0	6.3	32.6	37.9
Youngstown-Warren, Ohio	4.5	0.9	5.4	16.5	21.0
Cleveland-Akron, Ohio	35.7	6.9	42.6	95.4	131.1
Canton, Ohio	3.3	0.6	4.0	13.2	16.5
Columbus, Ohio	20.5	4.0	24.5	45.6	66.1
Dayton-Springfield, Ohio	10.9	2.1	13.0	33.6	44.5
Cincinnati, Ohio-Ky.-Ind.	20.6	4.0	24.6	53.8	74.4
Northwestern Rural Ohio	12.7	2.4	15.1	58.9	71.6
Toledo, Ohio	6.3	1.2	7.5	21.5	27.8
Detroit, Mich.	55.4	10.7	66.1	150.9	206.3
Flint, Mich.	3.6	0.7	4.3	14.9	18.5
Saginaw-Bay City, Mich.	3.5	0.7	4.2	13.5	17.1
Lansing-Jackson, Mich.	6.5	1.3	7.8	17.0	23.5
Battle Creek-Kalamazoo, Mich.	4.5	0.9	5.3	12.1	16.6
Grand Rapids-Muskegon, Mich.	8.7	1.7	10.4	29.0	37.7
Northern Rural Michigan	4.0	0.8	4.7	20.5	24.4
Southern Rural Michigan	4.1	0.8	4.9	18.0	22.1
South Bend, Ind.	6.5	1.3	7.8	20.8	27.3
Fort Wayne, Ind.	5.1	1.0	6.1	14.7	19.8
Indianapolis, Ind.	18.8	3.6	22.5	44.1	62.9
Northern Rural Indiana	13.1	2.5	15.6	60.0	73.0
Southern Rural Indiana	2.4	0.5	2.9	11.3	13.7
Evansville, Ind.-Kentucky	3.6	0.7	4.3	13.5	17.1
Southern Rural Illinois	1.4	0.3	1.6	8.0	9.4
Northern, Central Illinois	7.2	1.4	8.6	38.6	45.7
Springfield-Decatur, Ill.	4.0	0.8	4.8	10.4	14.4
Bloomington-Champaign, Ill.	4.4	0.9	5.3	9.1	13.5
Peoria, Ill.	4.4	0.8	5.0	11.3	15.6
Davenport-Moline, Ill.-Iowa	3.7	0.7	4.4	13.1	16.8
Chicago, Ill.-Indiana	148.0	30.5	178.5	293.6	441.6
Rockford, Ill.	3.6	0.7	4.3	10.0	13.6
Milwaukee-Racine, Wisc.	27.1	4.8	31.9	64.0	91.1
Madison, Wisc.	6.4	1.2	7.6	11.5	18.0
Green Bay-Appleton, Wisc.	6.1	1.1	7.2	17.4	23.5
Southern, Central Wisconsin	12.9	2.3	15.2	52.5	65.4
Northern Rural Wisconsin	1.5	0.3	1.8	8.9	10.5
Duluth, Minn.-Wisconsin	1.3	0.2	1.5	7.5	8.8
Northern Rural Minnesota	1.8	0.3	2.2	11.1	13.0
Minneapolis-St. Paul, Minn.	49.0	8.9	57.9	99.0	148.0
Southern Rural Minnesota	7.8	1.4	9.2	32.7	40.5

significant factor in the city's health. Eckart sees clear sailing for at least the next two years. After that? "A lot will depend on defense spending and tax laws," he says.

New downtown buildings include a 40-story Metropolitan Building and a 260,000-sq-ft four-story computer operations center for Mercantile Trust Co. In the past three years, three major hotels have been erected, and the old Union Station has been renovated into a shopping mall. St. Louis is not as severely overbuilt as other major markets, says the MIT-Arthur Andersen study.

Another healthy city is Indianapolis, whose downtown has been largely rejuvenated with new buildings and renovations. "A half dozen buildings are going up downtown," says Donald Rickets, Apex Ventilating Co. Some observers had feared that the new buildings would merely attract tenants from older downtown structures, but there has been a net gain in occupants, he believes. The city also expects an infusion of consumer spending when it hosts the Pan-Am games this summer.

Another city usually associated with a recession economy is Detroit, which has enjoyed something of a building boom in the past year. Much of its outer suburbs have blossomed with new offices, hotels, industrial projects, and service buildings.

Office space in primary office buildings in 1985 by market

	Amount of occupied primary office space	Amount of vacant primary office space	Total amount of primary office space	Amount of occupied other office space	Total amount of occupied office space
	(in millions of square feet)				
State of North Dakota	4.7	0.9	5.6	20.8	25.5
State of South Dakota	4.6	0.8	5.5	20.8	25.4
Northwestern Iowa	4.7	0.9	5.5	23.6	28.3
Cedar Rapids-Iowa City, Iowa	2.7	0.5	3.2	9.7	12.4
Des Moines, Iowa	9.2	1.7	10.8	15.2	24.3
Southeastern Iowa	7.2	1.3	8.5	32.2	39.3
Omaha, Neb.-Iowa	11.1	2.0	13.1	23.0	34.0
Lincoln, Neb.	3.4	0.6	4.0	7.6	11.0
Eastern Nebraska	2.0	0.4	2.3	11.8	13.8
Western Nebraska	2.2	0.4	2.6	12.8	15.0
Western Kansas	1.8	0.3	2.1	10.7	12.5
Wichita, Kan.	6.1	1.1	7.2	19.8	25.9
Eastern Kansas	5.1	0.9	6.0	23.7	28.8
Topeka, Kan.	2.9	0.5	3.5	8.2	11.1
Kansas City, Mo.-Kansas	23.5	4.3	27.7	59.0	82.5
Northern Rural Missouri	5.9	1.1	7.0	23.5	29.5
St. Louis, Mo.-Illinois	35.9	6.5	42.4	94.0	129.9
Springfield, Mo.	2.3	0.4	2.7	9.2	11.4
Southern Rural Missouri	4.5	0.8	5.3	27.7	32.1
Huntington, W.Va.	2.0	0.5	2.4	8.8	10.8

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Circle 12

Slowed job growth will pinch office building requirements

The MIT-Arthur Andersen report forecasts a precipitous decline in the rate of job growth for the West region. In the past decade, the region grew by nearly 4.4 million jobs. In the next ten years, jobs will grow by only 1.3 million. This promises to have a deeply negative effect on office space needs.

California leads the nation in office stock, with nearly 1.3 billion sq ft. The state is also severely overbuilt, the report says, with an excess of nearly 200 million sq ft by 1995 if present trends continue.

But Los Angeles seems to be infinitely expandable — all the way to San Diego in the south, Riverside in the east, and Ventura to the north. Its appetite for office buildings shows no sign of being satisfied, says contractor Maynard Center, Paller & Goldstein. "The central core of Los Angeles has a new office vacancy rate of 10% to 15%, but it is falling," he says. By the end of 1988 there may be "a considerable need" for new office space.

Center says the city remains an attractive area for real estate development by foreign investors. "One wave after another has swept us. We've had Canadian money, West German money, and certainly the Japanese are paying what appears to be overmarket prices to acquire new construction." He sees at least two years of office construction, and beyond that, "a big vacancy rate."

In San Francisco, there hardly seems to be enough vacant land to erect a mom-and-pop store, but the outlying suburbs have burgeoned. As the cost of maintaining offices in the central core increases, corporations are moving further on the perimeter. The Bay Area is not as overbuilt as many other markets, the MIT report claims. San Francisco could go about three years without any construction before a vacancy rate of 6% is reached. That figure is far lower than many other California markets. For example, other cities could go longer without reaching a 6% vacancy rate: Santa Barbara (6.4 years); Santa Cruz (8.5 years); Stockton (8.1 years); and Sacramento (6 years).

By contrast, Denver has all but dried up for new construction. "We're a carbon copy of Houston," says contractor Lou Bindner, Climate Engineering, Inc. "The economy has been hammered by the drop in energy prices." For example, the General Services Administration recently tried to auction off a one-half square block of prime land in downtown Denver: no takers.

Rental prices in Denver are running at half of what they were only five years ago, Bindner claims. "Building owners will practically kill on the streets to get a tenant. They're offering a year's free rent, cash rebates up front for a five-year lease, and all other kinds of creative leasing." It may take up to five years to absorb the market's excess space.

This drought has squeezed specialty contractors very hard. When Denver was roaring in the late 1970's, many out-of-town contractors set up branches. Most of them are still operating, but at sharply reduced strength. Ironically, many laid off mechanics have gotten a truck and some tools and are bidding retrofit work, further congesting the bidding and driving prices down.

Natkin's sheet metal operation remains in Denver, but Donald C. Koehler says the state is "kaput." The only salvation is an upward notch in oil prices, he says. "When the boom was on, a lot of oil people moved to Denver, taking four, five, six floors at a time." All that has ended.

By contrast, Phoenix, Ariz., remains a good market despite predictions of a 43% vacancy rate in ten years. Says contractor Howard E. Kraft, Climate Control, Inc., "We're a miniature Denver, but we're not as overbuilt as they are," he says. "If a major corporation moved its offices here, as Greyhound did ten years ago, it could absorb our surplus office space practically overnight. Ever since the Greyhound move, developers here have been 'betting on the come,' so we have quite a lot of space out here.

"But the market forces are a long way from ideal. If you have a stale or declining community, zero vacancy is too much."

Rental prices in Denver are running at half of what they were only five years ago, Bindner claims. "Building owners will practically kill on the streets to get a tenant. They're offering a year's free rent, cash rebates up front for a five-year lease, and all other kinds of creative leasing."

Construction to 1995 if overbuilding continues at present levels

	Total space 1985	Primary office space by 1995 if overbuilding continues	Primary office space built 1985 to 1995 if overbuilding continues	Primary office space built 1975 to 1985	Projected 1995 vacancy rates if overbuilding continues
	(in millions of square feet)				
Western New Mexico	4.3	6.7	2.4	2.0	27.1%
Albuquerque, N.M.	9.2	14.3	5.1	4.2	27.1%
Eastern New Mexico	2.3	3.7	1.3	1.3	32.1%
Eastern Colorado	3.5	5.4	1.9	1.7	28.2%
Colorado Springs-Pueblo, Colo.	5.7	8.5	2.8	2.5	27.1%
Denver-Boulder, Colo.	43.3	62.6	19.3	21.3	27.2%
Western Colorado	6.7	10.6	3.9	4.2	35.8%
State of Wyoming	4.4	6.7	2.3	2.4	23.6%
Eastern Montana	3.8	5.1	1.3	1.3	20.3%
Western Montana	3.1	4.3	1.3	1.4	22.1%
Rural Idaho	5.7	7.4	1.6	2.0	20.9%
Boise, Idaho	3.2	4.6	1.4	1.3	20.7%
Salt Lake City-Provo, Utah	17.1	23.6	6.5	7.1	29.6%
Rural Utah	2.2	3.9	1.7	1.4	36.2%
Rural Nevada	2.8	4.6	1.7	1.8	37.3%
Reno, Nev.	8.0	12.4	4.4	4.8	36.8%
Las Vegas, Nev.	14.3	23.5	9.2	8.7	35.5%
Rural Arizona	3.4	5.4	2.0	1.8	32.2%
Phoenix, Ariz.	40.4	78.0	37.6	26.3	45.7%
Tucson, Ariz.	9.1	15.7	6.6	5.7	35.3%
Northwest-East Rural California	3.6	4.6	1.1	1.6	32.0%
San Diego, Calif.	38.0	60.1	22.2	22.1	29.2%
Los Angeles, Calif.	282.0	437.6	155.6	148.7	31.9%
Santa Barbara, Calif.	5.8	8.5	2.8	2.8	30.7%
Santa Cruz-San Luis Obispo, Calif.	3.2	4.9	1.7	1.8	35.3%
Salinas-Seaside-Monterrey, Calif.	3.3	5.3	2.0	1.7	30.6%
Bakersfield, Calif.	4.2	7.0	2.8	2.5	34.2%
Central Valley, Calif.	6.3	9.7	3.4	3.4	32.8%
Fresno, Calif.	7.2	11.4	4.2	4.4	36.9%
Stockton-Modesto, Calif.	7.0	11.0	4.0	4.2	36.6%
San Francisco, Calif.	133.2	182.6	49.4	62.4	19.2%
Sacramento, Calif.	15.6	25.1	9.5	9.4	35.7%
Western Oregon	4.6	5.6	1.0	1.6	21.8%
Eugene, Ore.	2.6	3.4	0.8	1.0	21.1%
Portland-Salem, Ore.	24.2	31.4	7.3	7.4	18.4%
Eastern Oregon	1.7	2.2	0.5	0.8	23.4%
Spokane, Wash.	5.0	6.3	1.4	1.6	20.4%
Eastern Washington	5.4	7.0	1.6	2.0	21.2%
Seattle, Wash.	37.7	52.1	14.4	15.4	21.2%
Tacoma, Wash.	4.3	5.6	1.3	1.4	20.2%
Western Washington	7.0	8.7	1.8	2.3	20.8%
State of Alaska	6.2	8.6	2.4	2.8	22.3%
State of Hawaii	18.6	23.3	4.7	6.1	20.8%

Primary office space needed to achieve 6% vacancy rate in 1995

	Total primary office space 1985	Total primary office space 1995	Needed construction 1985 - 1995	Construction 1975 - 1985	Change in amount of construction
	(in millions of square feet)				
Western New Mexico	4.3	5.2	0.9	2.0	-1.1
Albuquerque, N.M.	9.2	11.1	1.9	4.2	-2.3
Eastern New Mexico	2.3	2.6	0.3	1.3	-1.0
Eastern Colorado	3.5	4.2	0.6	1.7	-1.1
Colorado Springs-Pueblo, Colo.	5.7	6.6	0.9	2.5	-1.6
Denver-Boulder, Colo.	43.3	48.5	5.1	21.3	-16.2
Western Colorado	6.7	7.2	0.6	4.2	-3.6
State of Wyoming	4.4	5.5	1.1	2.4	-1.3
Eastern Montana	3.8	4.3	0.5	1.3	-0.8
Western Montana	3.1	3.6	0.5	1.4	-0.9
Rural Idaho	5.7	6.2	0.5	2.0	-1.6
Boise, Idaho	3.2	3.8	0.7	1.3	-0.6
Salt Lake City-Provo, Utah	17.1	17.7	0.6	7.1	-6.5
Rural Utah	2.2	2.6	0.5	1.4	-1.0
Rural Nevada	2.8	3.1	0.2	1.8	-1.6
Reno, Nev.	8.0	8.3	0.3	4.8	-4.5
Las Vegas, Nev.	14.3	16.1	1.8	8.7	-6.8
Rural Arizona	3.4	3.9	0.5	1.8	-1.3
Phoenix, Arizona	40.4	45.0	4.6	26.3	-21.7
Tucson, Arizona	9.1	10.8	1.7	5.7	-4.0
Northwest-East Rural California	3.6	3.4	0.0	1.6	-1.6
San Diego, Calif.	38.0	45.3	7.3	22.1	-14.8
Los Angeles, Calif.	282.0	316.9	35.0	148.7	-113.7
Santa Barbara, Calif.	5.8	6.3	0.5	2.8	-2.2
Santa Cruz-San Luis Obispo, Calif.	3.2	3.4	0.2	1.8	-1.7
Salinas-Seaside-Monterrey, Calif.	3.3	3.9	0.6	1.7	-1.1
Bakersfield, Calif.	4.2	4.9	0.7	2.5	-1.8
Central Valley, Calif.	6.3	6.9	0.6	3.4	-2.8
Fresno, Calif.	7.2	7.6	0.5	4.4	-3.9
Stockton-Modesto, Calif.	7.0	7.4	0.4	4.2	-3.8
San Francisco, Calif.	133.2	157.0	23.8	62.4	-38.6
Sacramento, Calif.	15.6	17.2	1.6	9.4	-7.8
Western Oregon	4.6	4.6	0.0	1.6	-1.6
Eugene, Ore.	2.6	2.9	0.3	1.0	-0.7
Portland-Salem, Ore.	24.2	27.3	3.1	7.4	-4.2
Eastern Oregon	1.7	1.8	0.1	0.8	-0.7
Spokane, Wash.	5.0	5.4	0.4	1.6	-1.2
Eastern Washington	5.4	5.9	0.5	2.0	-1.5
Seattle, Wash.	37.7	43.7	6.0	15.4	-9.5
Tacoma, Wash.	4.3	4.7	0.4	1.4	-1.0
Western Washington	7.0	7.4	0.4	2.3	-1.9
State of Alaska	6.2	7.1	0.9	2.8	-1.9
State of Hawaii	18.6	19.6	1.0	6.1	-5.1

Office space in primary office buildings in 1985 by market

	Amount of occupied primary office space	Amount of vacant primary office space	Total amount of primary office space	Amount of occupied other office space	Total amount of occupied office space
	(in millions of square feet)				
Western New Mexico	3.3	1.0	4.3	15.3	18.6
Albuquerque, N.M.	7.0	2.2	9.2	17.3	24.4
Eastern New Mexico	1.8	0.5	2.3	8.5	10.2
Eastern Colorado	2.7	0.8	3.5	13.2	15.9
Colorado Springs-Pueblo, Colo.	4.3	1.4	5.7	15.3	19.7
Denver-Boulder, Colo.	34.0	9.4	43.3	75.8	109.8
Western Colorado	5.1	1.6	6.7	13.5	18.6
State of Wyoming	3.6	0.8	4.4	15.5	19.1
Eastern Montana	3.1	0.7	3.8	12.2	15.3
Western Montana	2.5	0.6	3.1	11.0	13.5
Rural Idaho	4.7	1.1	5.7	19.4	24.1
Boise, Idaho	2.6	0.6	3.2	7.0	9.6
Salt Lake City-Provo, Utah	12.8	4.3	17.1	44.2	57.0
Rural Utah	1.6	0.5	2.2	8.9	10.5
Rural Nevada	2.1	0.7	2.8	4.8	6.9
Reno, Nev.	6.0	2.0	8.0	7.6	13.6
Las Vegas, Nev.	10.7	3.6	14.3	17.7	28.4
Rural Arizona	2.5	0.8	3.4	16.4	18.9
Phoenix, Arizona	27.2	13.2	40.4	67.2	94.4
Tucson, Arizona	6.8	2.3	9.1	19.7	26.5
Northwest-East Rural California	2.7	0.9	3.6	13.4	16.1
San Diego, Calif.	29.8	8.1	38.0	63.8	93.7
Los Angeles, Calif.	211.5	70.5	282.0	450.4	661.8
Santa Barbara, Calif.	4.3	1.4	5.8	12.1	16.4
Santa Cruz-San Luis Obispo, Calif.	2.4	0.8	3.2	9.4	11.8
Salinas-Seaside-Monterrey, Calif.	2.5	0.8	3.3	8.2	10.6
Bakersfield, Calif.	3.2	1.1	4.2	12.9	16.0
Central Valley, Calif.	4.7	1.6	6.3	21.7	26.5
Fresno, Calif.	5.4	1.8	7.2	16.2	21.6
Stockton-Modesto, Calif.	5.3	1.8	7.0	18.7	24.0
San Francisco, Calif.	112.4	20.8	133.2	225.8	338.2
Sacramento, Calif.	11.7	3.9	15.6	35.2	46.9
Western Oregon	3.7	0.8	4.6	18.4	22.1
Eugene, Ore.	2.1	0.5	2.6	7.6	9.7
Portland-Salem, Ore.	20.0	4.2	24.2	50.7	70.7
Eastern Oregon	1.4	0.3	1.7	7.8	9.2
Spokane, Wash.	4.1	0.9	5.0	11.5	15.6
Eastern Washington	4.4	1.0	5.4	19.0	23.5
Seattle, Wash.	30.8	6.9	37.7	70.5	101.3
Tacoma, Wash.	3.5	0.8	4.3	12.7	16.2
Western Washington	5.7	1.3	7.0	25.2	30.9
State of Alaska	5.0	1.1	6.2	15.3	20.3
State of Hawaii	15.2	3.4	18.6	33.6	48.8

Oil-patch depression hurts building in Texas, Louisiana

The South region includes 16 states with wildly different office building needs. Some areas are booming, others are dry.

On the Washington, D.C., beltway, you are never out of sight of a tower crane, says Raymond Jung, of The Poole & Kent Co., Baltimore, Md. "Earlier, you were lucky if you had 30% of your volume in backlog," he says. "But this year, we've turned the corner with about seven months in the pipeline. For a while we were chewing up our backlog faster than we were booking new business." How much more building can Washington handle before saturation? It's got to end somewhere, Jung says. What comes out of all of those buildings is not a product, but a service — from trade associations, lobbies, think tanks. "How much longer can we go on washing each other's shirts?" he asks.

Down in Texas, office construction has slowed considerably. By 1995, the state will need only one-third of the 150 million sq ft it built in the past decade. If present building continues, Texas will have a 30% vacancy rate in ten years, says the MIT forecast.

But statistics can be deceptive, says Greg Miller, a market analyst for TD Mechanical, a large hvac contractor. There is still enough "tenant-finish" work to be done in new buildings where the prime tenant has moved in, but where the upper stories remain unfinished. "We're fortunate to be based in Dallas, where a large number of national builder-developers are situated," he says. "That means you can follow your customers out of state." TD Mechanical is now doing the Sun Bank Building in Orlando, Fla.

Construction history is cyclical, Miller says. "When you have so much vacant space, rental costs go down and you attract customers from out of state." In its heyday, Dallas could absorb 10 million

Construction to 1995 if overbuilding continues at present levels

	Total space 1985	Primary office space by 1995 if overbuilding continues	Primary office space built 1985 to 1995 if overbuilding continues	Primary office space built 1975 to 1985	Projected 1995 vacancy rates if overbuilding continues
	(in millions of square feet)				
Charleston, W.Va.	2.9	3.9	1.0	0.9	20.2%
Northwestern West Virginia	4.6	5.7	1.1	1.0	19.6%
Appalachian Mtn. Area, W.Va.	3.8	5.4	1.6	1.4	20.5%
Western Maryland	1.8	2.7	0.9	0.8	12.7%
Baltimore, Md.	34.2	45.3	11.0	10.0	10.0%
Eastern Maryland	2.2	3.2	1.0	0.9	12.4%
Southern Delaware	1.4	2.2	0.8	0.6	12.1%
Wilmington, Del.	8.2	11.1	2.9	2.5	12.0%
Washington, D.C.-Md.-Va.	88.0	133.1	45.1	40.9	6.5%
Mountain Region, Virginia	5.6	7.2	1.6	1.3	19.5%
Roanoke-Lynchburg, Va.	6.4	7.9	1.5	1.3	19.5%
Eastern Rural Virginia	8.4	10.6	2.3	2.9	21.8%
Richmond, Va.	18.1	23.2	5.2	6.2	21.7%
Norfolk-Virginia Beach, Va.	17.3	24.2	6.9	6.9	21.6%
Eastern North Carolina	19.2	26.0	6.8	6.6	20.9%

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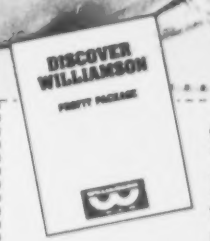

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Construction to 1995 if overbuilding continues at present levels

	Total space 1985	Primary office space by 1995 if overbuilding continues	Primary office space built 1985 to 1995 if overbuilding continues	Primary office space built 1975 to 1985	Projected 1995 vacancy rates if overbuilding continues
	(in millions of square feet)				
Raleigh-Durham, N.C.	12.4	18.3	6.0	5.8	22.8%
Greensboro-Winston-Salem, N.C.	17.3	21.9	4.7	4.9	20.4%
Charlotte, N.C.	21.9	28.2	6.4	6.9	21.0%
Mountain Region, North Carolina	10.9	13.1	2.2	2.1	19.6%
Greenville-Spartanburg, S.C.	11.7	16.4	4.7	5.4	23.6%
Eastern Rural South Carolina	7.9	11.3	3.4	3.4	22.3%
Charleston, S.C.	4.3	6.5	2.2	1.8	21.1%
Columbia, S.C.	8.4	10.9	2.5	2.7	21.0%
Northwestern Rural S.C.	3.3	4.7	1.4	1.1	20.0%
Augusta, Ga.-South Carolina	3.1	5.0	1.9	1.4	21.2%
Northern Mountain Region, Ga.	3.3	4.5	1.3	1.3	21.5%
Atlanta, Ga.	56.8	85.1	28.3	23.9	21.5%
Columbus, Ga.-Alabama	3.1	4.3	1.2	1.2	21.8%
Macon, Ga.	3.6	5.1	1.4	1.4	21.4%
Savannah, Ga.	3.3	4.8	1.5	1.4	21.6%
Rural Georgia	13.0	16.8	3.8	3.8	20.4%
Jacksonville-Gainesville, Fla.	19.1	25.6	6.6	6.6	21.1%
Daytona Beach, Fla.	3.7	5.5	1.8	1.6	21.3%
Melbourne-Titusville, Fla..	5.7	9.4	3.6	3.1	23.7%
Miami-Ft. Lauderdale, Fla.	71.6	100.4	28.7	28.8	21.7%
Rural South Florida	8.7	14.6	5.9	5.4	27.1%
Ft. Myers, Fla.	3.6	5.8	2.2	2.2	26.8%
Sarasota, Fla.	3.7	5.9	2.2	2.0	23.7%
Tampa-St. Petersburg, Fla.	29.9	43.1	13.2	12.2	21.5%
Lakeland-Winter Haven, Fla.	4.1	5.9	1.7	1.7	21.7%
Orlando, Fla.	17.0	27.3	10.3	9.1	23.6%
Northeastern Rural Florida	3.7	5.4	1.8	1.5	21.2%
Tallahassee, Fla.	2.5	4.0	1.5	1.2	22.1%
Northwestern Florida	3.0	4.6	1.6	1.2	20.5%
Pensacola, Fla.	2.7	3.9	1.2	1.2	22.2%
Mobile, Ala.	5.5	7.0	1.5	1.4	20.0%
Southern Rural Alabama	5.5	7.5	2.0	1.9	20.8%
Montgomery, Ala.	3.7	4.9	1.3	1.5	22.6%
Birmingham, Ala.	15.4	19.2	3.8	3.5	19.6%
Huntsville, Ala.	3.8	5.7	2.0	1.9	23.3%
Northern Rural Alabama	6.2	7.4	1.3	1.9	21.9%
Memphis, Tenn.-Arkansas	14.7	19.3	4.6	5.0	21.2%
Western Rural Tennessee	5.9	7.9	2.0	1.6	19.4%
Nashville, Tenn.	17.2	23.0	5.8	6.0	21.2%
Chattanooga, Tenn.-Georgia	6.3	7.6	1.4	1.6	20.5%

Construction to 1995 if overbuilding continues at present levels

	Total space 1985	Primary office space by 1995 if overbuilding continues	Primary office space built 1985 to 1995 if overbuilding continues	Primary office space built 1975 to 1985	Projected 1995 vacancy rates if overbuilding continues
	(in millions of square feet)				
Tennessee River Valley, Tenn.	5.4	6.1	0.7	0.4	18.6%
Knoxville, Tenn.	7.9	11.6	3.8	4.2	24.9%
Johnson City-Bristol, Tenn.	3.5	4.6	1.1	0.9	19.8%
Southeast Rural Kentucky	2.8	4.1	1.2	0.9	19.8%
Lexington, Ky.	5.1	7.3	2.2	2.2	22.5%
Louisville, Ky.-Indiana	14.1	17.7	3.6	2.6	18.9%
Northwestern Rural Kentucky	7.4	10.0	2.6	2.8	21.6%
Northern Mississippi	6.0	7.3	1.2	1.0	19.2%
Jackson, Miss.	6.9	9.2	2.3	2.4	21.0%
Southern Mississippi	7.3	9.9	2.6	2.3	20.2%
New Orleans, La.	24.1	34.0	9.9	8.4	20.4%
Baton Rouge, La.	7.9	12.7	4.8	3.6	21.2%
Lafayette, La.	4.2	7.4	3.3	2.7	26.5%
Southern Louisiana	10.5	15.7	5.2	5.1	23.1%
Northern Rural Louisiana	6.2	9.1	2.9	2.7	21.7%
Shreveport, La.	6.0	8.6	2.5	2.5	22.0%
Eastern Rural Arkansas	3.3	4.7	1.5	1.1	24.9%
Little Rock-Pine Bluff, Ark.	9.5	14.1	4.6	4.0	26.8%
Western Arkansas	4.5	6.4	1.9	1.6	25.7%
Ft. Smith-Fayetteville, Ark.	2.8	4.5	1.7	1.5	28.9%
Eastern Oklahoma	4.2	5.7	1.5	1.7	28.1%
Tulsa, Okla.	14.7	21.5	6.7	7.3	30.2%
Oklahoma City, Okla.	17.4	24.8	7.4	8.0	29.1%
Western Oklahoma	5.5	8.0	2.6	2.7	30.2%
Amarillo, Texas	2.7	4.2	1.5	1.4	29.0%
Lubbock, Texas	3.5	5.3	1.9	1.8	30.6%
Odessa-Midland, Texas	4.0	7.0	3.1	2.6	34.6%
North Panhandle, Texas	2.5	3.7	1.2	1.1	27.9%
Northcentral Texas	7.7	11.4	3.7	3.3	26.9%
Dallas-Ft. Worth, Texas	90.8	147.2	56.4	48.1	28.4%
Longview-Marshall-Tyler, Texas	4.3	7.3	3.0	2.6	32.2%
Beaumont-Port Arthur, Texas	4.3	6.1	1.9	2.1	30.0%
Houston-Galveston, Texas	87.1	139.3	52.2	50.2	33.7%
Eastern Texas	14.3	22.7	8.5	7.8	30.5%
Waco-Killeen-Temple, Texas	5.1	7.0	1.9	1.6	25.0%
Austin, Texas	15.4	28.6	13.2	10.5	36.2%
San Antonio, Texas	20.5	31.0	10.4	8.9	28.2%
Corpus Christi, Texas	4.7	7.8	3.1	2.6	30.4%
Brownsville-McAllen, Texas	4.3	7.0	2.7	2.6	32.9%
El Paso, Texas	5.6	9.2	3.6	2.7	26.8%

sq ft of space a year. Now it's down to about 6 million, but it's still one of the healthiest markets in the U.S., he contends.

The public sector in Dallas is still active. The city is doing a lot of school, library, and municipal work. City hall has been advised: now is the time to build, you'll never get a better price from hungry contractors.

Energy-based Houston has its share of "see-through" buildings: look through them and you see nobody inside. Job growth will be only half of what it was in the past decade, and the city could go for another six years without any new office construction before reaching a 6% vacancy rate.

Nor do things look much better in the adjacent states of Louisiana, Arkansas, and Oklahoma. They

But Statistics can be deceptive, says Greg Miller, a market analyst for TD Mechanical, a large hvac contractor. There is still enough "tenant-finish" work to be done in new buildings where the prime tenant has moved in, but where the upper stories remain unfinished. "We're fortunate to be based in Dallas, where a large number of national builder-developers are situated, " he says. "That means you can follow your customers out of state." TD Mechanical is now doing the Sun Bank Building in Orlando, Fla.

Primary office space needed to achieve 6% vacancy rate in 1995

	Total primary office space 1985	Total primary office space 1995	Needed construction 1985 - 1995	Construction 1975 - 1985	Change in amount of construction
	(in millions of square feet)				
Charleston, W.Va.	2.9	3.3	0.4	0.9	-0.5
Northwestern West Virginia	4.6	4.9	0.3	1.0	-0.7
Appalachian Mtn. Area, W.Va.	3.8	4.6	0.8	1.4	-0.6
Western Maryland	1.8	2.5	0.7	0.8	-0.1
Baltimore, Md.	34.2	43.4	9.1	10.0	-0.9
Eastern Maryland	2.2	3.0	0.8	0.9	-0.1
Southern Delaware	1.4	2.1	0.7	0.6	-0.1
Wilmington, Del.	8.2	10.4	2.2	2.5	-0.3
Washington, D.C.-Md.-Va.	88.0	132.4	44.4	40.9	3.5
Mountain Region, Virginia	5.6	6.1	0.6	1.3	-0.8
Roanoke-Lynchburg, Va.	6.4	6.7	0.4	1.3	-1.0
Eastern Rural Virginia	8.4	8.9	0.5	2.9	-2.4
Richmond, Va.	18.1	19.3	1.3	6.2	-4.9
Norfolk-Virginia Beach, Va.	17.3	20.2	2.8	6.9	-4.0
Eastern North Carolina	19.2	21.9	2.7	6.6	-3.9

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Primary office space needed to achieve 6% vacancy rate in 1995

	Total primary office space 1985	Total primary office space 1995	Needed construction 1985 - 1995	Construction 1975 - 1985	Change in amount of construction
	(in millions of square feet)				
Raleigh-Durham, N.C.	12.4	15.0	2.7	5.8	-3.1
Greensboro-Winston-Salem, N.C.	17.3	18.6	1.3	4.9	-3.5
Charlotte, N.C.	21.9	23.7	1.9	6.9	-5.0
Mountain Region, North Carolina	10.9	11.2	0.3	2.1	-1.8
Greenville-Spartanburg, S.C.	11.7	13.4	1.6	5.4	-3.8
Eastern Rural South Carolina	7.9	9.3	1.4	3.4	-2.0
Charleston, S.C.	4.3	5.5	1.1	1.8	-0.7
Columbia, S.C.	8.4	9.2	0.8	2.7	-1.9
Northwestern Rural S.C.	3.3	4.0	0.7	1.1	-0.4
Augusta, Ga.-South Carolina	3.1	4.2	1.1	1.4	-0.3
Northern Mountain Region, Ga.	3.3	3.8	0.5	1.3	-0.7
Atlanta, Ga.	56.8	71.1	14.4	23.9	-9.6
Columbus, Ga.-Alabama	3.1	3.5	0.5	1.2	-0.8
Macon, Ga.	3.6	4.2	0.6	1.4	-0.8
Savannah, Ga.	3.3	4.0	0.7	1.4	-0.7
Rural Georgia	13.0	14.2	1.2	3.8	-2.6
Jacksonville-Gainesville, Fla.	19.1	21.5	2.5	6.6	-4.2
Daytona Beach, Fla.	3.7	4.6	0.9	1.6	-0.6
Melbourne-Titusville, Fla..	5.7	7.6	1.9	3.1	-1.2
Miami-Ft. Lauderdale, Fla.	71.6	83.6	11.9	28.8	-16.8
Rural South Florida	8.7	11.3	2.6	5.4	-2.8
Ft. Myers, Fla.	3.6	4.5	0.9	2.2	-1.3
Sarasota, Fla.	3.7	4.8	1.1	2.0	-0.9
Tampa-St. Petersburg, Fla.	29.9	36.0	6.1	12.2	-6.1
Lakeland-Winter Haven, Fla.	4.1	4.9	0.8	1.7	-0.9
Orlando, Fla.	17.0	22.2	5.2	9.1	-3.9
Northeastern Rural Florida	3.7	4.6	0.9	1.5	-0.6
Tallahassee, Fla.	2.5	3.3	0.8	1.2	-0.4
Northwestern Florida	3.0	3.9	0.9	1.2	-0.3
Pensacola, Fla.	2.7	3.3	0.5	1.2	-0.7
Mobile, Ala.	5.5	5.9	0.5	1.4	-0.9
Southern Rural Alabama	5.5	6.3	0.8	1.9	-1.1
Montgomery, Ala.	3.7	4.1	0.4	1.5	-1.1
Birmingham, Ala.	15.4	16.4	1.0	3.5	-2.4
Huntsville, Ala.	3.8	4.7	0.9	1.9	-1.0
Northern Rural Alabama	6.2	6.2	0.0	1.9	-1.9
Memphis, Tenn.-Arkansas	14.7	16.2	1.4	5.0	-3.5
Western Rural Tennessee	5.9	6.8	0.9	1.6	-0.7
Nashville, Tenn.	17.2	19.3	2.1	6.0	-3.9
Chattanooga, Tenn.-Georgia	6.3	6.4	0.2	1.6	-1.4

Primary office space needed to achieve 6% vacancy rate in 1995

	Total primary office space 1985	Total primary office space 1995	Needed construction 1985 - 1995	Construction 1975 - 1985	Change in amount of construction
	(in millions of square feet)				
Tennessee River Valley, Tenn.	5.4	5.3	0.0	0.4	-0.4
Knoxville, Tenn.	7.9	9.3	1.4	4.2	-2.7
Johnson City-Bristol, Tenn.	3.5	3.9	0.4	0.9	-0.5
Southeast Rural Kentucky	2.8	3.5	0.6	0.9	-0.3
Lexington, Ky.	5.1	6.0	0.9	2.2	-1.3
Louisville, Ky.-Indiana	14.1	15.2	1.2	2.6	-1.4
Northwestern Rural Kentucky	7.4	8.4	0.9	2.8	-1.9
Northern Mississippi	6.0	6.3	0.2	1.0	-0.8
Jackson, Miss.	6.9	7.8	0.8	2.4	-1.5
Southern Mississippi	7.3	8.4	1.1	2.3	-1.2
New Orleans, La.	24.1	28.8	4.7	8.4	-3.7
Baton Rouge, La.	7.9	10.6	2.7	3.6	-0.9
Lafayette, La.	4.2	5.8	1.6	2.7	-1.0
Southern Louisiana	10.5	12.8	2.3	5.1	-2.7
Northern Rural Louisiana	6.2	7.6	1.4	2.7	-1.3
Shreveport, La.	6.0	7.1	1.1	2.5	-1.4
Eastern Rural Arkansas	3.3	3.8	0.5	1.1	-0.6
Little Rock-Pine Bluff, Ark.	9.5	11.0	1.5	4.0	-2.5
Western Arkansas	4.5	5.0	0.6	1.6	-1.1
Ft. Smith-Fayetteville, Ark.	2.8	3.4	0.6	1.5	-0.9
Eastern Oklahoma	4.2	4.4	0.2	1.7	-1.5
Tulsa, Okla.	14.7	16.0	1.2	7.3	-6.1
Oklahoma City, Okla.	17.4	18.7	1.3	8.0	-6.7
Western Oklahoma	5.5	5.9	0.5	2.7	-2.2
Amarillo, Texas	2.7	3.2	0.4	1.4	-0.9
Lubbock, Texas	3.5	3.9	0.5	1.8	-1.3
Odessa-Midland, Texas	4.0	4.9	0.9	2.6	-1.6
North Panhandle, Texas	2.5	2.8	0.3	1.1	-0.8
Northcentral Texas	7.7	8.9	1.2	3.3	-2.1
Dallas-Ft. Worth, Texas	90.8	112.1	21.3	48.1	-26.7
Longview-Marshall-Tyler, Texas	4.3	5.3	0.9	2.6	-1.7
Beaumont-Port Arthur, Texas	4.3	4.6	0.3	2.1	-1.8
Houston-Galveston, Texas	87.1	98.1	11.1	50.2	-39.1
Eastern Texas	14.3	16.8	2.6	7.8	-5.2
Waco-Killeen-Temple, Texas	5.1	5.6	0.5	1.6	-1.1
Austin, Texas	15.4	19.4	4.0	10.5	-6.5
San Antonio, Texas	20.5	23.6	3.1	8.9	-5.8
Corpus Christi, Texas	4.7	5.8	1.1	2.6	-1.5
Brownsville-McAllen, Texas	4.3	5.0	0.7	2.6	-1.8
El Paso, Texas	5.6	7.1	1.6	2.7	-1.1

reflect the same overbuilt condition and retarded job growth as Texas. Louisiana has seen a steep drop in its oil-based economy. The state leads the nation with an unemployment rate of 14% — a dubious distinction. New Orleans contractor Douglas Stubbs, Atlas Blow Pipe & Sheet Metal, doesn't see any relief for at least the next 18 months. "I think people around here have been spoiled by all of the growth in the early 80's," he says. That was the boom period, which got an extra stimulation from the World's Fair. But today, office buildings and hotels have caught up with the demand. "All of the work is in Florida now," he says.

But in Florida, the new tax law threatens to scale back drastically the construction of condos and multifamily units. "We're overbuilt like everybody else," says Donald Dolan, an executive with the South Florida Mechanical Contractors Association of America. "More office space, more hotels, more condos." he muses. "It seems to be overbuilt, then it fills up again. But the future is bright here."

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Office space in primary office buildings in 1985 by market

	Amount of occupied primary office space	Amount of vacant primary office space	Total amount of primary office space	Amount of occupied other office space	Total amount of occupied office space
	(in millions of square feet)				
Charleston, W.Va.	2.4	0.6	2.9	10.0	12.3
Northwestern West Virginia	3.7	0.9	4.6	19.7	23.5
Appalachian Mtn. Area, W.Va.	3.1	0.7	3.8	17.3	20.4
Western Maryland	1.6	0.2	1.8	6.9	8.4
Baltimore, Md.	30.9	3.3	34.2	79.3	110.2
Eastern Maryland	2.0	0.3	2.2	8.5	10.4
Southern Delaware	1.2	0.2	1.4	6.5	7.7
Wilmington, Del.	7.2	0.9	8.2	19.8	27.1
Washington, D.C.-Md.-Va.	82.3	5.6	88.0	135.2	217.5
Mountain Region, Virginia	4.5	1.1	5.6	24.5	29.0
Roanoke-Lynchburg, Va.	5.1	1.2	6.4	15.9	21.1
Eastern Rural Virginia	6.8	1.6	8.4	26.5	33.2
Richmond, Va.	14.6	3.5	18.1	29.4	44.0
Norfolk-Virginia Beach, Va.	14.0	3.3	1.3	41.6	55.6
Eastern North Carolina	15.5	3.7	19.2	67.8	83.3

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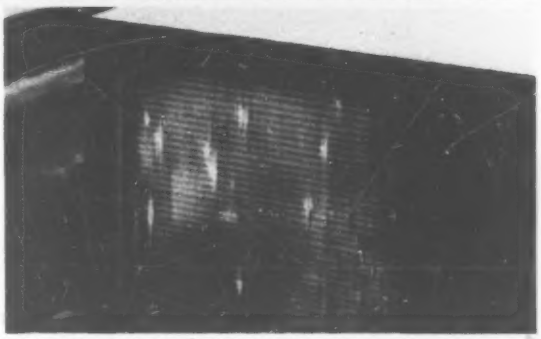

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Office space in primary office buildings in 1985 by market

	Amount of occupied primary office space	Amount of vacant primary office space	Total amount of primary office space	Amount of occupied other office space	Total amount of occupied office space
	(in millions of square feet)				
Raleigh-Durham, N.C.	10.0	2.4	12.4	26.7	36.7
Greensboro-Winston-Salem, N.C.	14.0	3.3	17.3	34.9	48.9
Charlotte, N.C.	17.7	4.2	21.9	41.9	59.6
Mountain Region, North Carolina	8.8	2.1	10.9	39.1	47.9
Greenville-Spartanburg, S.C.	9.5	2.3	11.7	26.2	35.7
Eastern Rural South Carolina	6.4	1.5	7.9	28.5	34.9
Charleston, S.C.	3.5	0.8	4.3	13.1	16.6
Columbia, S.C.	6.8	1.6	8.4	13.2	20.0
Northwestern Rural S.C.	2.7	0.6	3.3	12.9	15.6
Augusta, Ga.-South Carolina	2.5	0.6	3.1	11.5	14.0
Northern Mountain Region, Ga.	2.7	0.6	3.3	12.2	14.8
Atlanta, Ga.	45.8	11.0	56.8	101.9	147.6
Columbus, Ga.-Alabama	2.5	0.6	3.1	7.1	9.6
Macon, Ga.	2.9	0.7	3.6	9.0	12.0
Savannah, Ga.	2.7	0.6	3.3	8.1	10.8
Rural Georgia	10.5	2.5	13.0	53.7	64.2
Jacksonville-Gainesville, Fla.	15.4	3.7	19.1	34.8	50.2
Daytona Beach, Fla.	3.0	0.7	3.7	8.8	11.7
Melbourne-Titusville, Fla..	4.6	1.1	5.7	11.7	16.4
Miami-Ft. Lauderdale, Fla.	57.9	13.8	71.6	127.6	185.5
Rural South Florida	7.0	1.7	8.7	22.3	29.4
Ft. Myers, Fla.	2.9	0.7	3.6	7.9	10.8
Sarasota, Fla.	3.0	0.7	3.7	7.7	10.6
Tampa-St. Petersburg, Fla.	24.1	5.7	29.9	61.0	85.2
Lakeland-Winter Haven, Fla.	3.3	0.8	4.1	11.0	14.3
Orlando, Fla.	13.8	3.3	17.0	32.5	46.3
Northeastern Rural Florida	3.0	0.7	3.7	14.2	17.1
Tallahassee, Fla.	2.1	0.5	2.5	5.6	7.7
Northwestern Florida	2.4	0.6	3.0	9.7	12.1
Pensacola, Fla.	2.2	0.5	2.7	9.0	11.2
Mobile, Ala.	4.4	1.1	5.5	12.9	17.3
Southern Rural Alabama	4.4	1.0	5.5	21.5	25.9
Montgomery, Ala.	3.0	0.7	3.7	9.2	12.2
Birmingham, Ala.	12.5	3.0	15.4	35.6	48.0
Huntsville, Ala.	3.0	0.7	3.8	8.2	11.2
Northern Rural Alabama	5.0	1.2	6.2	26.4	31.4
Memphis, Tenn.-Arkansas	11.9	2.8	14.7	34.4	46.3
Western Rural Tennessee	4.8	1.1	5.9	22.9	27.7
Nashville, Tenn.	13.9	3.3	17.2	34.2	48.1
Chattanooga, Tenn.-Georgia	5.1	1.2	6.3	14.6	19.6

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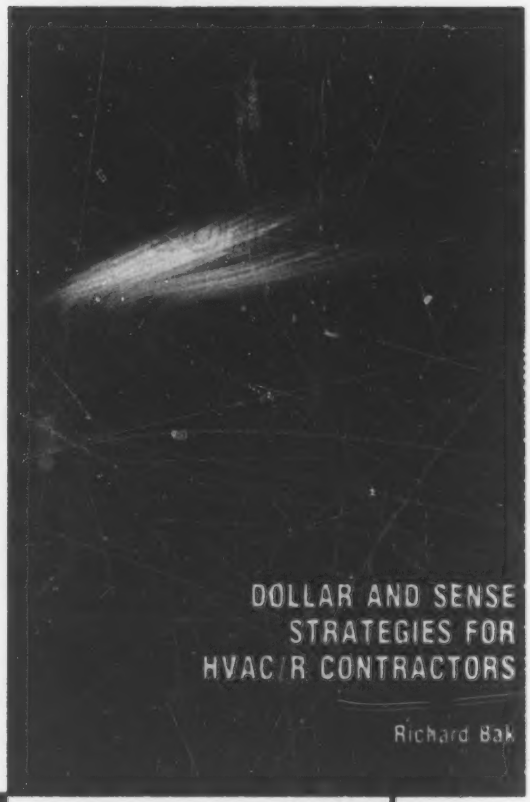

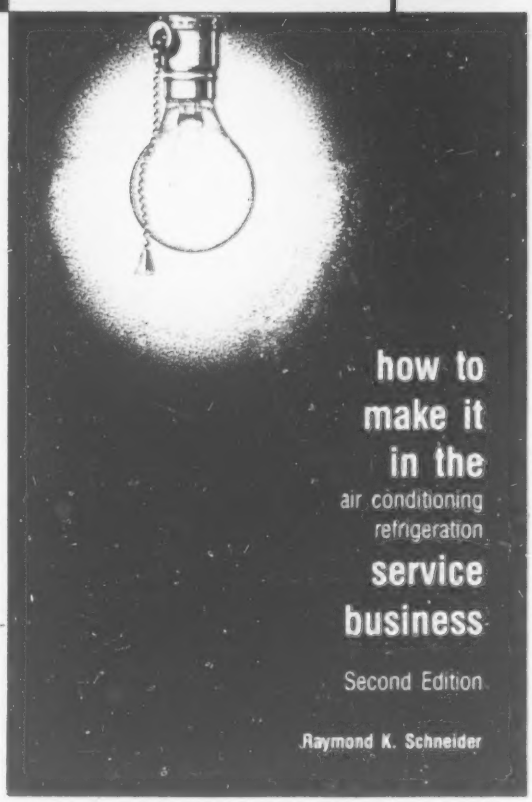

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Office space in primary office buildings in 1985 by market

	Amount of occupied primary office space	Amount of vacant primary office space	Total amount of primary office space	Amount of occupied other office space	Total amount of occupied office space
	(in millions of square feet)				
Tennessee River Valley, Tenn.	4.4	1.0	5.4	20.0	24.4
Knoxville, Tenn.	6.4	1.5	7.9	18.3	24.6
Johnson City-Bristol, Tenn.	2.8	0.7	3.5	14.1	16.9
Southeast Rural Kentucky	2.3	0.5	2.8	16.4	18.7
Lexington, Ky.	4.1	1.0	5.1	13.3	17.4
Louisville, Ky.-Indiana	11.4	2.7	14.1	35.0	46.4
Northwestern Rural Kentucky	6.0	1.4	7.4	31.4	37.4
Northern Mississippi	4.9	1.2	6.0	26.0	30.9
Jackson, Miss.	5.6	1.3	6.9	12.5	18.1
Southern Mississippi	5.9	1.4	7.3	27.7	33.6
New Orleans, La.	19.5	4.6	24.1	43.6	63.1
Baton Rouge, La.	6.4	1.5	7.9	17.0	23.4
Lafayette, La.	3.4	0.8	4.2	8.6	12.0
Southern Louisiana	8.5	2.0	10.5	28.7	37.2
Northern Rural Louisiana	5.0	1.2	6.0	18.8	23.8
Shreveport, La.	4.9	1.2	6.0	11.9	16.8
Eastern Rural Arkansas	2.5	0.8	3.3	15.3	17.8
Little Rock-Pine Bluff, Ark.	7.2	2.3	9.5	20.4	27.6
Western Arkansas	3.4	1.1	4.5	21.4	24.8
Ft. Smith-Fayetteville, Ark.	2.2	0.7	2.8	9.9	12.0
Eastern Oklahoma	3.2	1.0	4.2	17.1	20.3
Tulsa, Okla.	11.2	3.5	14.7	27.5	38.7
Oklahoma City, Okla.	13.2	4.1	17.4	35.8	49.1
Western Oklahoma	4.2	1.3	5.5	18.7	22.9
Amarillo, Texas	2.1	0.7	2.7	6.7	8.8
Lubbock, Texas	2.6	0.8	3.5	8.2	10.8
Odessa-Midland, Texas	3.0	0.9	4.0	9.1	12.1
North Panhandle, Texas	1.9	0.6	2.5	14.0	15.9
Northcentral Texas	5.8	1.8	7.7	26.9	32.7
Dallas-Ft. Worth, Texas	69.8	21.0	90.8	147.3	217.1
Longview-Marshall-Tyler, Texas	3.3	1.0	4.3	11.6	14.8
Beaumont-Port Arthur, Texas	3.2	1.0	4.3	12.3	15.5
Houston-Galveston, Texas	65.5	21.6	87.1	132.6	198.0
Eastern Texas	10.9	3.4	14.3	52.0	62.8
Waco-Killeen-Temple, Texas	3.9	1.2	5.1	12.4	16.3
Austin, Texas	11.7	3.7	15.4	24.0	35.8
San Antonio, Texas	15.4	5.1	20.5	40.0	55.4
Corpus Christi, Texas	3.6	1.1	4.7	11.6	15.1
Brownsville-McAllen, Texas	3.3	1.0	4.3	13.4	16.6
El Paso, Texas	4.3	1.3	5.6	15.1	19.3

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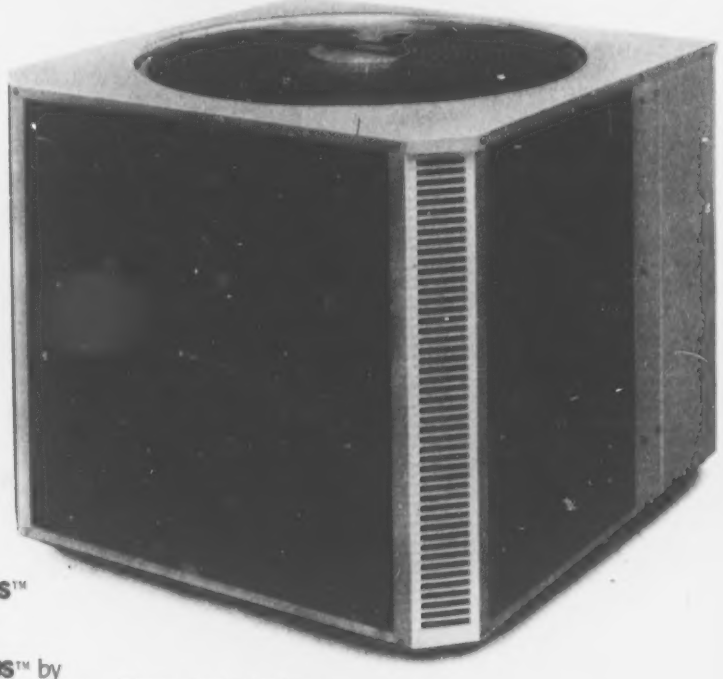

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RELATED PRODUCTS

Sales bookings for industrial air pollution control equipment, which peaked at just over $1 billion in 1979, spiraled downward during the intervening years until 1986 when an overall 75% increase was reported by the Industrial Gas Cleaning Institute (IGCI).

Total new orders for 1986 amounted to $267.8 million, up 75% from the $153 million total of new orders reported in the previous year.

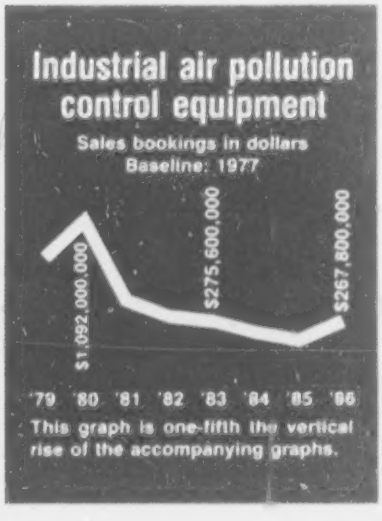
Flue gas desulphurization equipment bookings, at $112.5 million in 1986, increased by a whopping 1,164% over the depressed total of only $8.9 million in 1985. For perspective, it might be noted that this volatile market peaked in 1979 with bookings of $404 million. And as late as 1983, bookings totaled $191.7 million.

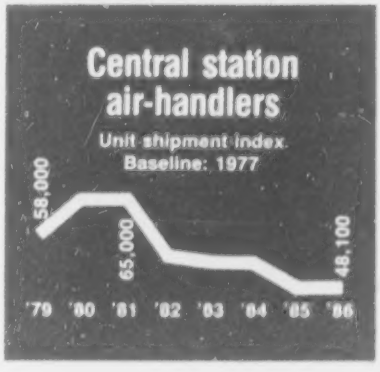
Another major increase was reported for gaseous emission controls. Bookings in 1986 totaled $23 million, an increase of 379% over the $4.8 million total for the previous year.

The booking value for electrostatic precipitators in 1986, at $56 million, represented a 51.4% increase over the year-previous total of $37 million. The total for 1984 was $70.6 million.

Fabric filter bookings, at $65.7 million in 1986, were down 17.8% from the $80 million total reported for 1985.

Mechanical collector booking values, which totaled $4.3 million last year, were down 55.2% from the $9.6 million total reported for 1985.


Industrial air pollution control equipment
Sales bookings in dollars
Baseline: 1977
$1,092,000,000
$275,600,000
$267,800,000
'79 '80 '81 '82 '83 '84 '85 '86
This graph is one-fifth the vertical rise of the accompanying graphs.



Wet scrubber bookings, at $6.3 million in 1986, were down 50.3% from the $12.7 million total for the previous year. The 1984 total was $17 million, according to IGCI.

The institute statistics cover new orders for installation in the U.S. and Canada. All orders include bare flange-to-flange hardware with the exception of flue gas desulphurization equipment, which includes the total contract value.

Power humidifiers

After several years in the doldrums, power humidifier shipments are climbing back to the half-million unit range they enjoyed in much of the 1970's thanks to lower interest rates and healthy new and existing home markets.

We feel that power humidifier shipments increased last year by 12% to 475,000 units. The 425,000-unit total for 1985 itself represented a 13% increase over the total for the previous year. Looking ahead, we feel that a 500,000-unit year in 1987 is attainable, particularly if home sales continue strong and interest rates stay at present levels.

Even though approximately nine of 10 power humidifiers are installed in existing homes, and only about 10% go into new homes, they often are installed soon after a new or existing home is purchased by people who, for reasons of health or comfort, feel they want the benefits of humidification. A strong new home market and a record year for existing home sales in 1986, many feel, helped sell more power humidifiers.

Another major consideration has been interest rates. When home improvement loans were in the 15% to 20% range, accessories such as humidifiers often were dropped from consideration. But at today's much lower interest rates, it would appear that more homeowners are opting for the accessories.

Too, housing markets in the Midwest and Northeast have made a significant recovery. A 1984 Energy Information Administration study indicated that, of the 11.3 million humidifiers in U.S. homes, 6.3 million were in the Midwest and 2.5 million were in the Northeast.

There has been some fear — so far unfounded — that the power humidifier market would be limited by a growing number of tightly insulated homes. Because infiltration rates are so low in these homes, ventilation units containing air-to-air heat exchangers or dehumidifiers often are needed to reduce indoor humidity

rather than add to it.

So far in the U.S., it would seem that not enough of these super-insulated homes have been built to make a significant difference in the humidifier market.

For the record, the Bureau of the Census reported that 422,385 central and self-contained humidifiers were shipped in 1985, the latest year for which these figures are available. That's a 1.2% decline from the 1984 total of 427,504 humidifiers the bureau reported were shipped in 1984. These figures contain both central power humidifiers and console types.

Fans

Both divisions of the Air Movement and Control Association (AMCA) reported increases in all categories in 1986 with the exception of centrifugal fans.

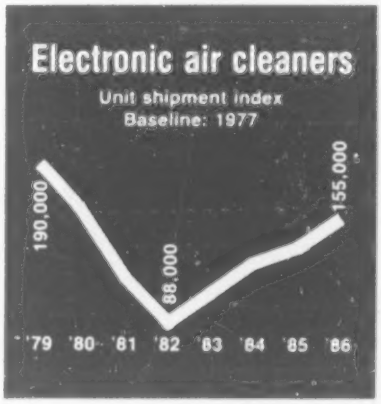
In the Air Movement Division, shipments of centrifugal fans in 1986 totaled $119,013,321, a decline of 4.5% from the prior-year total of $124,554,256.

Industrial axial and propeller fans, at $62,061,091 last year, showed an increase of 18.6% over the total for 1985 of $52,316,413.

The total value of power roof ventilator shipments in 1986 was $83,227,289, an increase of 10.6% over the 1985 total of $75,265,726.

In the Air Control Division, shipments of louvers, dampers, and shutters in 1986 totaled $62,807,777, an increase of 2.8% over the total of $61,125,237 in the previous year.

AMCA in 1978 eliminated fans shipped to the power generation market and placed them in another category. The Air Movement Division figures are based on reports from more than 60 manufacturers while the Air Control Division figures represent the total of reports submitted by 22 companies.



Central station air handlers

Shipments of central station air handlers totaled 48,100 units in 1986, just 0.4% ahead of the 47,900-unit total for the previous year. Bookings for central station air handlers were down 5% at the start of 1987 but the decline this year could be much steeper.

Electronic air cleaners

Helped by a strong new home market and record existing home sales, shipments of electronic air cleaners improved again in 1986. Last year's total of 155,000 units represented a 12% improvement over the previous year's total of 138,400 units.

Although the improvement in housing aetivity has been credited with the increases of the last three years, eac manufacturers are hoping that increased public awareness of indoor air quality problems will bring this product out of the marketing doldrums.

Electronic air cleaners also have a special compatibility with heat pumps because of their ability to keep the indoor coil clean in winter when it has little or no condensate to help remove airborne dust. Research also is being conducted to determine the effectiveness of eac's in collecting the short-lived radon daughters that characteristically attach themselves to airborne particulates.

Like humidifiers and other accessories, eac's have been a victim of high interest rates. When rates were high, many suspected that the accessories

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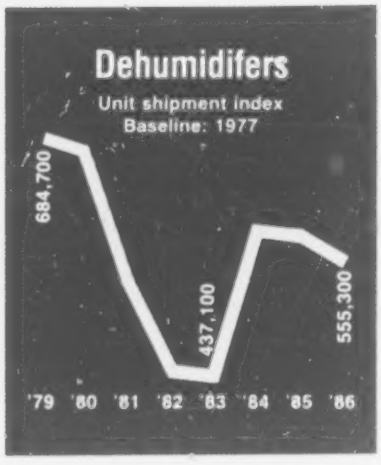

were rejected for economic reasons. Now that interest rates are more reasonable, it appears that eac's are again being considered as an option.

Dehumidifiers

Shipments of dehumidifiers, which reached a peak of 684,700 units in 1978, declined again in 1986, according to the Association of Home Appliance Manufacturers (AHAM).

Shipments last year totaled 555,300 units, down 5.6% from the total of 588,400 units shipped in the previous year.

It might be noted that, in its latest report, the Bureau of the Census reported 589,136 self-contained dehumidifiers were shipped in 1985, down 0.5% from the revised total of 586,003 units shipped in 1984.

Refrigerants

Shipments of the three most common fluorocarbon refrigerants — R-22, R-12, and R-11 — in 1986 totaled 797,606,000 pounds, an increase of 20.25% over the total of 663,263,000 pounds shipped in the previous year, according to figures released by the International Trade Commission.

Shipments of R-11 last year totaled 201,254,000 pounds, an increase of 23.8% over the prior-year total of 162,621,000 pounds.

Shipments of R-12 in 1986 totaled 322,336,000 pounds, an increase of 14.3% over the 281,942,000 pounds shipped by U.S. producers in 1985.

Shipments of R-22, at 274,016,000 pounds last year, reflected an increase of 25.3% over the total of 218,700,000 pounds shipped in 1985.

On a world basis (excluding Eastern Europe and China) the end use of 1985 shipments of R-11 broke down this way: refrigeration 8.3%; blowing agent for closed-cell foam 35.9%; blowing agent for open-cell foam 19.4%; aerosol propellant 30.7%; other uses 5.7%.

The 1985 end uses for 1985 world shipments of R-12 broke down this way: refrigeration 49.2%; blowing agent for closed-cell foam 8%; blowing agent for open-cell foam 5.4%; aerosol propellant 31.8%; other uses 5.6%.

It should be noted that, in the U.S., the use of these refrigerants as aerosol propellants have been prohibited for most applications for several years.

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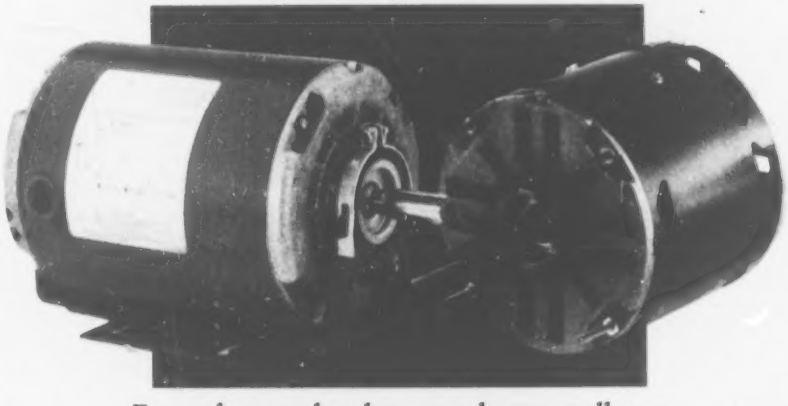

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Circle 47

COMFORT AND

If there was a common denominator among the trends in the comfort conditioning industry in the past year, it was the fact that the sale of high-efficiency equipment held steady in the face of eroding fuel prices and much diminished public discussion about energy problems.

Even though the gains posted by high-efficiency equipment were small in 1986, it must be remembered they were painted on a canvas that already contained record or near-record shipment figures for many products, an across-the-board drop in fuel prices, and a shift in growth markets from the South to the Northeast and Midwest.

The emphasis on energy efficiency is likely to become even more pronounced over the next few years as manufacturers, wholesalers, and contractors prepare for the implementation, in 1989, of mandatory minimum efficiency standards for home heating and cooling equipment. The legislation, passed by Congress again earlier this year, promises yet another dramatic improvement in overall efficiency levels.

The standard also underlines the need to provide training for the contractors who will be installing and servicing this high-efficiency equipment. This is especially true for contractors who, until now, have managed to get by without learning about the intricacies of ignition, venting, and airflow necessary for the proper operation of these newer equipment types.

There were some significant shifts in fuel preferences over the past year, some of them a reflection of price changes and some because of growth market shifts.

The dramatic 35% to 40% drop in fuel oil prices that began in late 1985 resulted in significant penetration gains among new homes built in oil's traditional Northeast market. The base was small, however, and the only apparent victims were heat pumps in that region and, to a lesser extent, in the Midwest.

The decline in oil prices had a much more significant effect on natural gas, already troubled by an oversupply "bubble" and declining industrial-electricity generation markets. The sharp drop in the price of residual oil — chief competitor of gas in the industrial-electricity generation markets — has had the effect of putting a ceiling on most gas utility prices.

Gas sales to these two principal markets, which once accounted for more than half of all gas sales, shrunk by another 10% in 1986 to a 35% share of the total despite many creative marketing efforts by utilities and pipeline suppliers. Residential gas prices declined by 6.7% in 1986. This followed a 2.6% decline the previous year.

The cost of electricity, of major concern in the South where cooling seasons are long and where most heat pumps and electric resistance heating is located, also recorded an overall decline of 5.6% last year in the average price charged residential customers. Although the 1986 experience was largely a reflection of fuel competition, the price of electricity can be expected to decline further after 1990 when much of the cost of new generating capacity has been absorbed.

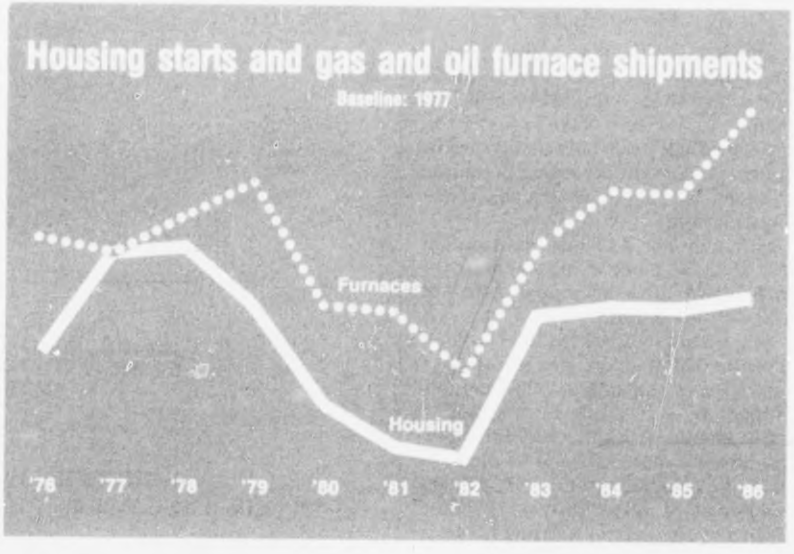
A look back

To provide some fuel price perspective, it must be remembered that today's "low" oil prices still are 50% higher than they were in 1978. The average price of natural gas for U.S. homes today is 50% higher than 1980 prices — and 328% higher than in 1973. Similarly, the average price of electricity charged residential customers today is 69% higher than in 1978 and 187% higher than in 1973.

These changes, initiated by the Arab oil embargo in 1973, have been uneven as one fuel, then another, changed in price relative to its competitors. These changes, and the perceptions they have created among consumers, have had a major impact on the home comfort industry. But before we look at tomorrow, we should look back a few years.

Back in the early 1970's the efficiency of an air conditioner, a heat pump, a furnace, or a boiler was largely an academic consideration. Those who made or sold equipment with efficiencies markedly ahead of the competition could find few who appreciated the difference enough to pay the premium cost. Price was supreme and equipment was considered almost a commodity.

As energy prices escalated, manufacturers and distributors found they could no longer serve the market with any single efficiency. Contractors found that homeowners were demanding higher efficiencies for replacement and add-on equipment. Later, builders found that tighter, better-insulated homes with efficient heating and cooling equipment sold more quickly.



Over the intervening years, manufacturers were forced to market cooling equipment lines in at least two efficiency ranges. Real and threatened state minimum efficiency standards, together with a wide range of electric utility rebates based on efficiency, influenced many to market three efficiency ranges. About five years ago, home heating equipment followed suit and, today, most manufacturers offer furnaces and boilers in three efficiency ranges.

The road to higher efficiencies came about in three distinct phases. The first was an awareness of the need for change to avoid high operating costs. It took the form of added insulation, weatherization, the elimination of pilots on many gas-fired appliances, more coil surface on air conditioners and heat pumps, and an interest in solar, wood, and other renewable energy sources.

The second phase — departures from traditional equipment to designs based on new technology and a growing consumer willingness to pay more for higher efficiencies — had its beginnings in 1979 but did not develop fully until 1984. It was then, too, that the renewable energy movement reached its high-water mark. No longer were furnaces merely an extension of the ductwork. Nor was there competition to see how little coil surface was needed for a given capacity.

The third phase began about 1983 and will be with us for the forseeable future. It's a time when consumer and government education is largely complete. And although the federal minimums are a bit higher than we'd like, there is still enough room at the top for the marketplace to work. Too, the interval between now and 1992 (1990 for room air conditioners) when the standards take effect, should provide an orderly upward progression without market disruptions.

The march toward higher efficiencies so far has been distinguished by the ability of the industry to provide the efficiencies demanded in the marketplace and by the consumer's unexpectedly high degree of understanding about the extra investment required. Although utility incentives surely helped, they were not the deciding factor.

We don't expect any quantum leaps in overall average efficiencies as the industry prepares for the higher mandatory minimums, especially in view of falling fuel prices. The big question, which is still five or six years away from an answer, is whether the mandatory minimums will constitute only

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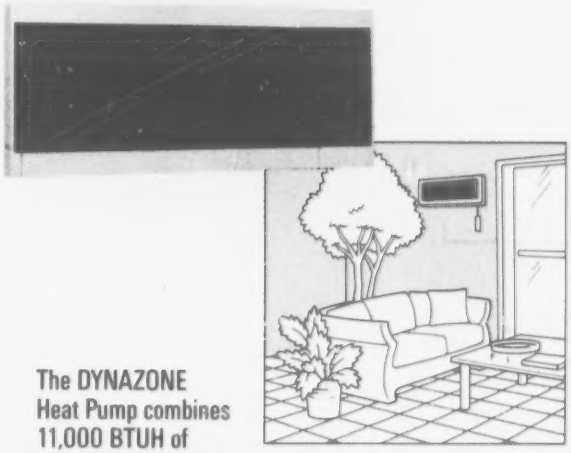

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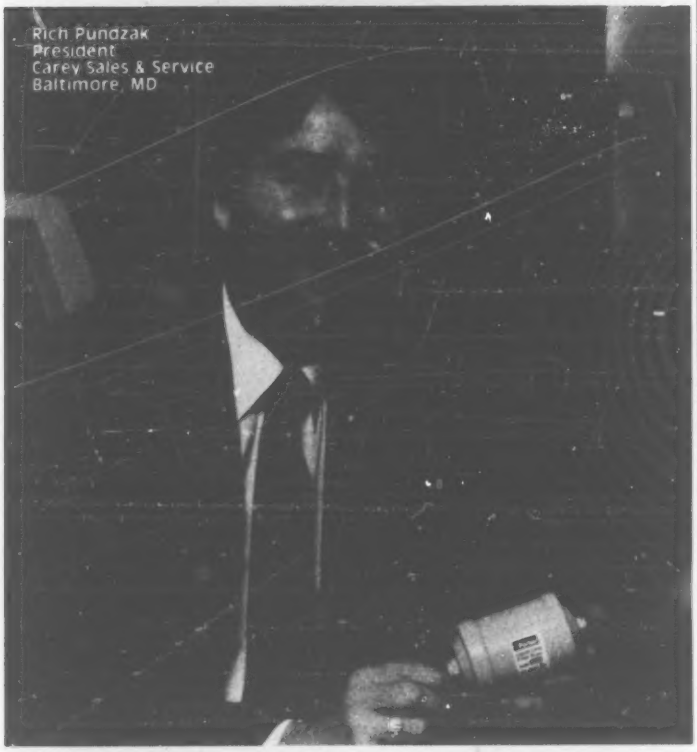

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a floor or will they, in effect, represent both a floor and a ceiling.

Heating

In the days of cheap and abundant natural gas, there was little incentive to purchase anything better than an inherently reliable and inexpensive atmospheric gas furnace or boiler with a standing pilot that, in most cases, burned all summer to keep rust and dampness from the simple clamshell heat exchanger.

These atmospheric gas furnaces and boilers had a steady state efficiency of at least 80% but, on an annual basis, they had to press hard to achieve efficiencies in the 60% range. The natural venting arrangement meant conditioned air was vented up the flue whether the furnace was operating or not.

With the first stage of natural gas decontrol in 1978, which reversed the increasingly severe curtailments of the previous decade, came steep price increases that more than doubled operating costs. The first remedy, made mandatory in some states, was the intermittent ignition device (iid) to replace the standing pilot. This increased efficiencies to the 67% to 71% range and a vent damper, which reduced the amount of conditioned air vented between cycles, could add another 8% or so.

The next stage was a family of gas-fired equipment with power burners, induced draft, or recuperative heat exchangers. They constituted a new class of equipment with efficiencies in the 80% to 86% range. They stopped just short of condensing the flue gases.

A pulse combustion boiler was introduced in 1980 and, two years later, it was joined by a pulse combustion furnace. Both had annual efficiencies well over 90% and, in the next three years, virtually every manufacturer entered the market with a condensing furnace with efficiencies of 90% or higher.

A new market

These developments were watched with more than passing interest by homeowners eager to control fast-rising energy bills. The result was a whole new market revolving around the replacement of inefficient equipment in good working order for the sake of efficiency.

A breakdown of manufacturer shipments by efficiency range reported by the Gas Appliance Manufacturers Association (GAMA) illustrates the

Circle 37

change in consumer buying habits. The report includes upflow, downflow, and horizontal furnaces expanded to show industry volume.

In 1983, the first year these statistics were reported, 26.7% of all furnaces shipped had an AFUE (annual fuel utilization efficiency) of less than 65%. Only five years before, remember, this class had represented more than nine of every 10 furnaces sold. Last year furnaces with AFUE's of less than 65% accounted for 13.5% of total shipments, or 283,340 units, down from 14.9% of shipments in the previous year.

At the other end of the spectrum, 15.4% of the furnaces shipped in 1983 had AFUE's of 80% or better. A year later that percentage had risen to 31% and, in 1985, it was 31.3%. Last year 30.9% of the furnaces shipped, or 650,550 units, had AFUE's of 80% or more.

Even though the percentage of high-efficiency furnaces shipped has remained essentially flat for three years, the number of condensing furnaces (AFUE's of 86% or more) has grown steadily from 11.1% of shipments in 1984 to 12.3% in 1985 and 15.8%, or 331,915 units, last year. Obviously all of this growth has been at the expense of equipment in the 80% to 86% range.

In between these extremes, 44.8% of the units (942,035) shipped last year had AFUE's of 65% to 71% and another 10.9% (228,810 units) had AFUE's of from 71% to 80%. Both percentages were virtually unchanged from the previous year.

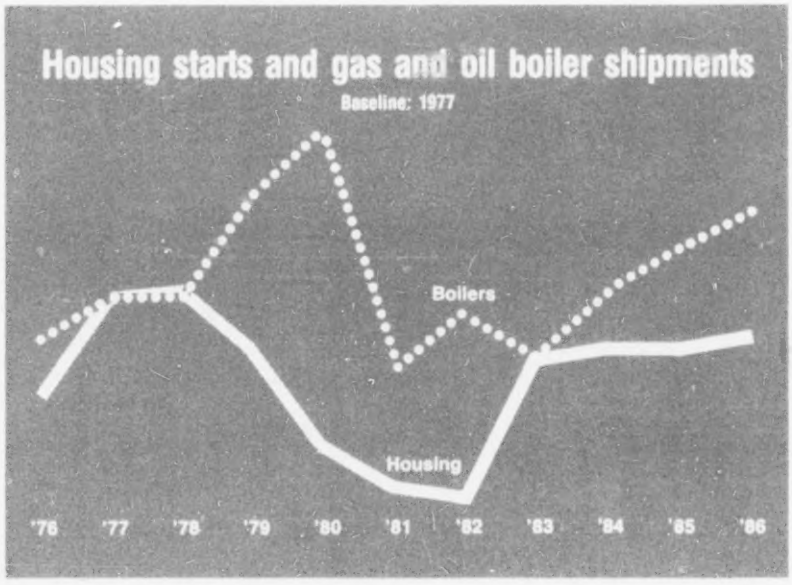
The figures demonstrate that nearly a third of the furnaces shipped in the last three years already meet the minimum standard of 78% AFUE effective in 1992 for all but the smallest furnaces. Now that the standard is in place, we think it reasonable to assume that this percentage will increase sharply over the next two years as contractors point out the relatively small price differential.

Other figures supplied by GAMA showed that the picture for oil-fired furnaces was a bit different. The 105,035 oil furnaces with AFUE's of 80% or better shipped last year accounted for 52.4% of total shipments — up from 34.9% of shipments in 1985. The high-efficiency share in 1983 was 24.2%.

Conversely, oil furnaces with AFUE's of less than 75% accounted for only 12,170 units last year, or 6.1%. That percentage is down from 9.5% a year earlier. Similarly, the grouping with AFUE's of 75% to 80%, at 83,335 units last year, accounted for 41.6% of shipments. A year earlier it was 55.7% of shipments.

It would appear, then, that oil furnaces have a somewhat smaller step upward to mandatory efficiency levels than their gas counterparts. At the same time, however, it is unlikely there will be many condensing oil furnaces for the next few years. Yet vir-

TURN TO PAGE 91



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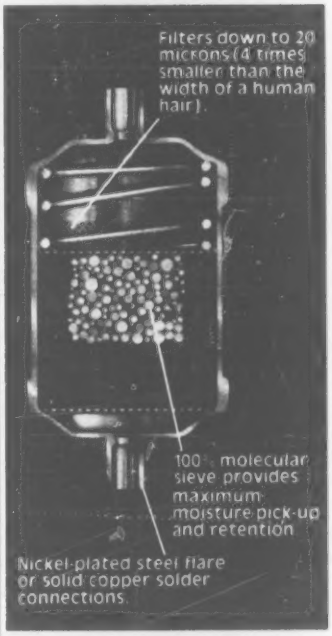
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Heating-cooling-fuel new home characteristics

	1985					1986				
	U.S. total	Northeast	North Central	South	West	U.S. total	Northeast	North Central	South	West
Single-family homes completed	**771,000**	119,000 15.4%	103,000 13.4%	377,000 48.9%	172,000 22.3%	**800,000**	134,000 16.7%	113,000 14.1%	370,000 46.2%	184,000 23%
Space heating fuel										
Gas	335,000 43.4%	46,000 38.7%	78,000 75.7%	108,000 28.6%	103,000 59.9%	374,000 46.8%	58,000 43.3%	88,000 77.7%	111,000 30%	116,000 63%
Electricity	385,000 49.9%	46,000 38.7%	22,000 21.4%	259,000 68.7%	58,000 33.7%	365,000 45.6%	42,000 31.3%	21,000 18.6%	248,000 67%	55,000 29.9%
Oil	20,000 2.6%	20,000 16.8%	— —	— —	— —	33,000 4.1%	29,000 21.6%	1,000 0.9%	1,000 0.3%	— —
Other/none	31,000 4.1%	7,000 5.8%	3,000 2.9%	10,000 2.7%	11,000 6.4%	29,000 3.6%	5,000 3.7%	4,000 3.5%	11,000 3%	12,000 6.5%
Heating system type										
Central heating	691,000 89.6%	95,000 79.8%	96,000 93.2%	353,000 93.6%	146,000 84.9%	719,000 89.9%	109,000 81.3%	106,000 93.8%	342,000 92.4%	161,000 87.5%
Warm air ducted	659,000 85.5%	66,000 55.5%	95,000 92.2%	353,000 93.6%	145,000 84.3%	668,000 83.5%	64,000 47.8%	104,000 92%	342,000 92.4%	160,000 87.5%
Warm air furnace	422,000 54.7%	44,000 36.9%	84,000 81.5%	183,000 48.5%	105,000 61.1%	437,000 54.6%	45,000 33.6%	94,000 83.2%	175,000 47.3%	124,000 67.4%
Heat pump	236,000 30%	22,000 18.5%	10,000 9.7%	169,000 44.8%	35,000 20.3%	232,000 29%	20,000 14.9%	10,000 8.8%	166,000 44.8%	36,000 19.6%
Hydronic	33,000 4.3%	28,000 23.5%	4,000 3.8%	— —	— —	50,000 6.3%	45,000 33.6%	3,000 2.7%	— —	1,000 0.5%
Built-in	81,000 10.5%	24,000 20.2%	8,000 7.8%	24,000 6.4%	25,000 14.5%	80,000 10%	24,000 17.9%	8,000 7%	27,000 7.3%	22,000 12%
Electric	49,000 6.3%	21,000 17.6%	5,000 4.8%	12,000 3.2%	11,000 6.4%	45,000 5.6%	19,000 14.2%	5,000 4.4%	10,000 2.7%	9,000 4.9%
Other/none	31,000 4.1%	4,000 3.5%	— —	13,000 3.5%	21,000 12.2%	37,000 4.6%	4,000 3%	2,000 1.8%	16,000 4.3%	13,000 7%
With central air conditioning	542,000 70.3%	49,000 41.1%	63,000 61.1%	346,000 91.7%	84,000 48.8%	559,000 69.9%	59,000 44%	69,000 61%	340,000 91.9%	91,000 49.5%
Multifamily homes completed	**476,000**	33,000 6.9%	55,000 11.6%	234,000 49.2%	154,000 32.3%	**467,000**	43,000 9.2%	71,000 15.2%	196,000 42%	157,000 33.6%
Space heating fuel										
Gas	144,000 30.2%	18,000 54.5%	26,000 47.2%	26,000 11.1%	74,000 48.1%	156,000 33.4%	22,000 51.2%	29,000 40.9%	25,000 12.8%	81,000 51.6%
Electricity	327,000 68.7%	13,000 39.3%	30,000 54.5%	207,000 88.4%	77,000 50%	301,000 64.5%	13,000 30.2%	32,000 45%	171,000 87.2%	74,000 47.1%
Oil	1,000 0.2%	1,000 3.1%	— —	— —	— —	6,000 1.3%	5,000 11.6%	— —	— —	— —
Other/none	4,000 0.9%	1,000 3.1%	— —	1,000 0.5%	3,000 1.9%	4,000 0.9%	1,000 2.3%	— —	1,000 0.5%	2,000 1.3%
With air conditioning	417,000 87.6%	21,000 63.6%	53,000 96.3%	229,000 97.8%	114,000 74%	410,000 87.8%	35,000 81.4%	67,000 94.4%	194,000 98.9%	114,000 72.6%

SOURCE: Two quarters revised, one quarter preliminary, Census Bureau figures. All numbers are rounded. Built-in "electric" includes electric baseboard, panel, or radiant heat. Built-in "other" includes room or space heaters, floor or wall furnaces, solar, and other types of heating.

FROM PAGE 89

tually all replacement oil burners sold today are retention-head or other high-efficiency types.

It should be noted that there are two exceptions to the 78% AFUE minimum standard for furnaces manufactured after Jan. 1, 1992. The minimum AFUE for mobile home furnaces is 75% and, for furnaces with inputs of less than 45,000 Btuh, a minimum somewhere between 71% and 78% has yet to be established by DOE.

The rapid increases in furnace efficiencies have not come without some growing pains. Substantially higher service costs for gas-fired equipment compared to the old atmospheric-standing pilot models are likely to continue. The atmospheric-standing pilot models will virtually disappear from the market in 1992.

Some early problems — premature corrosion of heat exchangers and venting systems, improper installation by poorly trained contractors, and nuisance shutdowns caused by faulty controls — have largely been overcome. A few remain, however, especially the task of training contractors in the much more demanding needs of venting systems.

While the industry is agreed on such subjects as plastic vents and better stainless steel formulations for heat exchangers, it is still divided on whether or not it's best to use outdoor air for combustion. Some designs use outdoor air for combustion on grounds its corrosion potential is much less than indoor air that's often laden with household cleaning and cooking vapors. Even vapor from chlorinated public water supplies is a suspected villain.

Still needed are guidelines for common venting with other appliances, such as gas-fired water heaters, and for general ventilation to control the build-up of humidity and indoor contaminants caused by cooking, cleaning, and bathing. Both the research community and manufacturers are working on answers to these questions.

Heat pumps

Electric furnaces for many years merely replaced electric resistance baseboard and ceiling cable systems so that ducted central cooling also could be provided. In the 1980's, however, they have been playing second fiddle to the heat pump.

As in recent years, heat pumps accounted for a quarter of all unitary shipments in 1986. The heat pump share of the new single-family home market, at 29% last year, slipped a bit because of the slow housing market in the South, its principal market. We estimated multifamily heat pump penetration also was down from 40% to 35% for the same reason.

It should be noted that heat pump penetration among single-family homes in the South remained constant over the past two years at 44.8%, or more than twice the rate of any other region.

The initial reason for the popularity of the air-to-air heat pump was the lack of natural gas availability in many markets until 1978. Then, when gas became plentiful, it suffered from steep price increases and a sparse infrastruc-

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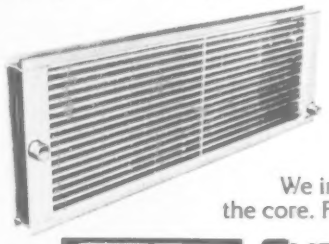

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Circle 51

ture in the South where, until two years ago, more than half of new housing construction was taking place.

Even last year the South, which requires a lot of cooling and minimal heating, accounted for 46% of new single-family home completions. The trend toward garden homes, condominiums, and individually metered rental apartments also helped heat pumps. On the negative side, lower oil prices and growth in the Northeast and Midwest housing markets has had a marginal dampening effect on heat pumps.

A small market that surged briefly and then declined was the replacement of split-system comfort cooling units with split-system heat pumps on gas, oil, and electric furnaces. The heat pump provides summer cooling and heating when outdoor temperatures are above the balance point (the lowest outdoor temperature at which the heat pump can supply 100% of the heating requirement). The regular furnace takes over at outdoor temperatures below the balance point, or at another temperature based on the relative fuel costs.

The market, which depends almost wholly on conversions, surged briefly when fuel prices escalated sharply. Because most of the potential conversions already have been made, and because fuel costs are dropping, this market has become a very minor factor in the marketplace. Some gas utilities, with limited success, attempted to assess a demand charge on gas furnace-heat pump combinations on grounds they were being forced to provide gas only in peak demand periods.

The heat pump, however, still has a magic about it that the gas industry envies. It has devoted a lot of time and money to the development of a gas-fired heat pump that can compete head-on with electric heat pumps. Gas engine-drive heat pumps have attracted the attention of Japanese researchers and, to a lesser extent, those in the U.S.

Gas heat pump research appears to be several years away from a design that can compete in both first cost and operating cost with electric units. A major problem for the gas industry has been the dramatic increase in average efficiencies for electric heat pumps.

The performance of electric air-to-air heat pumps, particularly in northern applications, has improved significantly in recent years. Cooling performance, although still a compromise, has been upgraded to the point where it now rivals the best cooling-only units. Compressors have been reinforced to handle the rigors of more defrost cycles and longer operating hours. Defrost systems and controls, some of which provide improved diagnostics, have been upgraded.

The Air-Conditioning and Refrigeration Institute (ARI) reported that, of 1986 shipments, the sales-weighted average of all unitary heat pumps of 65,000 Btuh and under was 8.7 SEER (seasonal energy efficiency ratio), up from 8.56 SEER a year earlier. In 1984

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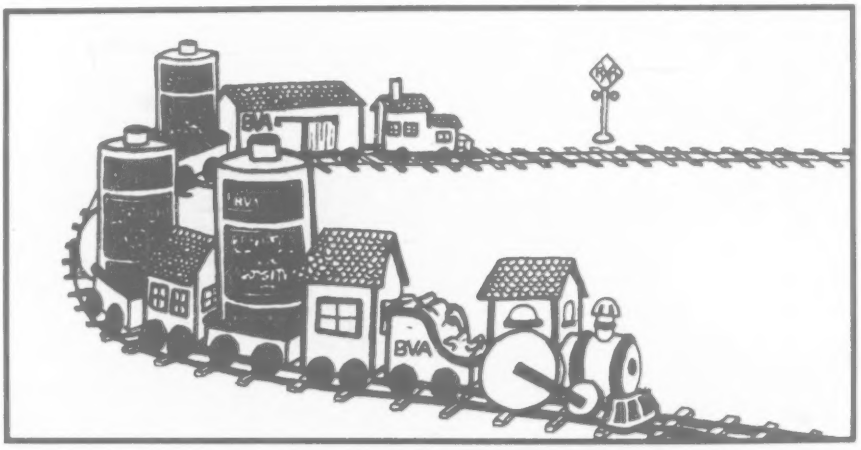

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Circle 6

Bureau of the Census data

A 10-year look at air conditioning and refrigeration unit shipments

Product	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Condensing units	417,286	529,515	537,082	497,833	455,695	439,714	379,787	458,538	440,388	414,126
Compressors and compressor units	22,761,950	23,991,643	25,790,862	24,970,111	19,829,319	21,233,348	17,433,817	20,690,897	22,774,869	19,854,110
Ammonia compressors	1,453	1,443	1,819,	2,014	1,860	1,808	1,509	1,173	1,233	1,056
Screw compressors[1]	—	—	—	—	5,809	5,320	2,620	3,601	—	—
Fancoil units[2]	193,587	198,939	186,827	178,719	245,127	253,832	207,232	214,799	209,001	197,877
Induction units[3]	21,112	—	—	—	33,343	—	—	—	—	—
Central-station air handlers	48,616	52,371	52,441	60,266	60,841	59,866	58,961	56,301	53,413	56,627
Unitary air conditioners[4]	2,399,638	2,829,447	3,226,998	3,057,009	1,881,465	1,991,507	1,568,838	2,067,152	2,448,677	2,482,721
Unitary heat pumps (air-to-air)	320,043	536,558	371,436	646,926	508,457	604,903	408,742	660,956	803,669	879,485
Water-source heat pumps	—	—	—	—	69,931	69,689	86,092	69,280	86,165	65,821
Packaged terminal air conditioners	182,608	261,777	148,332	183,274	143,212	143,427	135,741	150,073	184,780	172,256
Packaged terminal heat pumps[1]	—	—	—	—	—	32,439	52,512	58,753	93,549	81,964
Room air conditioners	2,805,124	3,303,335	4,030,423	3,757,102	3,178,993	3,722,509	2,883,156	1,888,075	3,039,491	2,669,950
Centrifugal chillers[5]	2,994	2,977	2,975	3,141	4,200	3,938	3,893	4,089	2,289	2,782
Reciprocating chillers	7,114	8,665	9,003	9,695	12,325	12,090	11,668	10,533	13,788	13,734
Absorption chillers	571	588	470	392	279	239	199	135	153	131
Adsorption, open type absorption	1,866	2,318	2,704	2,503	2,962	3,171	1,461	1,044	1,087	1,074
Cooling towers[2]	11,156	8,517	9,906	—	12,185	15,381	11,222	11,344	10,853	10,787
Evaporative condensers	2,094	2,299	2,453	3,263	2,881	2,859	2,166	2,149	2,426	2,508
Mobile vehicle air conditioners	11,978,679	9,459,535	9,074,932	7,651,198	5,852,328	6,059,342	5,651,329	9,267,612	12,196,385	13,008,516
Mobile air conditioners for trucks, agricultural, construction equipment	2,320,911	2,452,820	1,298,198	1,352,198	764,942	834,174	1,064,381	1,557,060	1,948,655	2,154,467
Mobile vehicle refrigeration systems[6]	70,836	76,536	70,731	76,395	60,301	66,773	68,843	66,502	36,548	44,916
Recreational vehicle air conditioners[1]	—	—	—	—	93,919	119,566	142,227	156,689	173,914	172,841
Unit coolers[7]	195,738	197,975	194,905	187,434	175,371	169,487	163,697	187,612	179,726	203,956
Ice-making machines	187,887	165,106	194,049	218,827	166,725	165,626	150,475	166,399	218,281	281,956
Drinking water coolers	307,570	335,173	373,885	411,687	409,782	432,733	373,560	429,258	528,043	564,884
Dehumidifiers	502,141	351,188	477,692	728,148	734,738	540,386	438,833	610,013	586,003	589,136
Humidifiers (central and self-contained)[1]	—	—	—	—	423,986	396,413	310,342	324,948	427,504	422,385

Source: Bureau of the Census Current Industrial Reports MA 35M, Air Conditioning and Refrigeration Equipment, including Warm Air Furnaces. [1]New category since 1980. [2]Excludes vertical stack units in 1977. [3]Withheld to avoid disclosing operations of individual companies. [4]For years 1980 through 1985, add these figures to those for unitary heat pumps (air-to-air) and subtract exports from that total to get comparable industry figures. [5]Excludes open type units for 1978 and succeeding years. Also excludes units 200 hp and under and units 401 to 500 hp. [6]Excludes railway freight cars for 1978 and succeeding years. [7]Excludes floor-mounted dry and spray types for 1979 and succeeding years.

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the heat pump average was 8.4 SEER. Back in 1976, when records of this type were first kept, only 4.5% of residential heat pumps shipped that year could boast of an SEER of 8.5 or better.

Even so, the industry average still has a way to go to match the mandatory federal minimum of SEER 10 for split-system and SEER 9.7 for single-package heat pumps manufactured after Jan. 1, 1992, and 1993 respectively. On the positive side, many manufacturers now offer heat pumps that meet or exceed to new standard. The few others have nearly five years to reach that point.

Even though they are sold in much fewer numbers than the other heating systems, water-source heat pumps are making themselves felt in some northern markets, particularly in the Midwest. They have been used in the South, especially Florida, for many years.

Most of the early "cold water" units used water from a well, a pond, or the ocean. Available water quantity and quality usually was unknown until the job was started and, often, a separate return well had to be drilled. For these reasons, early installations were largely a rural phenomenon.

Researchers and some enterprising entrepreneurs in recent years have developed vertical and horizontal closed-loop designs using plastic pipe and a water-glycol solution that substantially reduce drilling and pumping costs. They also make the system practical on an urban lot.

The systems provide high efficiency water-cooled air conditioning in summer and high efficiency heating in winter without the need for back-up heat for cold weather. They are expensive (two to three times the cost of a high-efficiency gas furnace) and require extra system engineering, factors that limit growth rates. Nevertheless, these systems have exhibited steady growth over the past five years.

Another system just starting to take hold in several mid-South and Midwest markets is the integrated appliance. These systems use a gas-fired domestic hot water heater to supply hot water to a coil in a separate air handler that, in turn, acts as a furnace to supply space heating. They may, and usually do, also contain an evaporator connected to a split-system air conditioner to provide comfort cooling.

These units, which have allowed gas utilities to get back into the condominium, town house, and rental apartment markets, also are used for single-family homes. By making use of what formerly were water heater standby storage losses, the systems have proven to be competitive with gas furnaces in the over-80% range.

Cooling

In the late 1960's and early 1970's, the condenser surfaces of central air conditioners got smaller and smaller and condenser fan speeds got higher and higher as manufacturers tried to hold the line on price in a competitive market dominated by builder purchases.

The EER's (energy efficiency ratios) didn't matter so long as the first cost was low. Electricity was cheap and, after all, the builder didn't have to pay the utility bills. But as electricity costs spiraled upward, particularly in the South where cooling seasons are long, the industry began developing equipment to meet the growing demand for higher efficiencies.

In the early stages, builders held to low-cost, low-efficiency units. But as homebuyers became more knowledgeable and more demanding, and as manufacturers developed equipment with higher efficiencies for the more discerning add-on and replacement markets, builders began opting for better units as part of an energy-saving merchandising package.

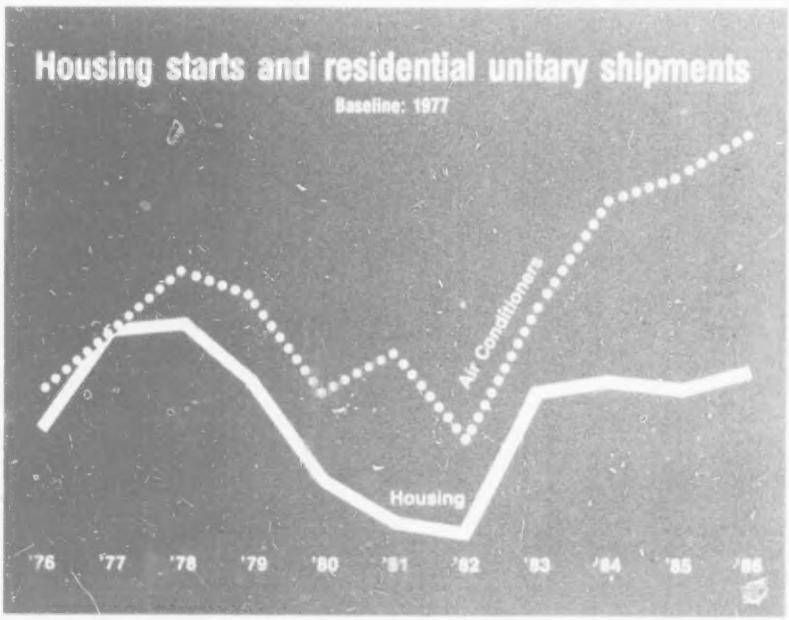
Within the hvac industry, condenser surfaces were expanded and multiple-speed condenser fans were added, moves that made outdoor units quieter as well. The push from municipalities for sound ordinances to control air conditioner noise all but disappeared. Too, as air conditioning penetration increased, more windows were closed at night.

Compressors were improved and two-speed models were offered by several manufacturers. Larger commercial units began to be equipped routinely with multiple compressors to provide more modulation and, as a side benefit, lower first costs because of the economies of scale in the manufacture of the smaller compressors.

Until 1976, we doubt that much more than 15% of the residential units (65,000 Btuh and under) shipped could be classified as high-efficiency units. At that time, an EER of 7.5 was posted by us as the dividing line. That picture has changed dramatically.

ARI reported that, of 1986 shipments of unitary air conditioners in this class, the sales-weighted average SEER was 8.868, up a hair from the 8.82 a year earlier. The average for split-system cooling-only units was 8.867, up slightly from 8.84 a year earlier. Similarly, the average for cooling-only single packages was 8.874 in 1986, up from 8.71 in 1985.

Significantly, the increase in each year's average has been small over each of the last few years. Although



the equipment is available, only about one in 10 units shipped last year would have met the mandatory minimums of 9.7 SEER (for single packages) and 10 SEER (for split systems) slated for 1993 and 1992 respectively.

A major benefit of the federal legislation will be the elimination of separate state efficiency minimums. Not only have these state minimums created a number of minimarkets that destroyed economies of scale, but the "me, too" and "me toughest" leapfrog syndromes promised much worse conditions in the future. Now, however, virtually all states have endorsed the federal approach, as have manufacturers and the environmental groups who opposed the previous "no-standard standard" with a successful lawsuit.

More important than state minimums in promoting the acceptance of higher comfort cooling equipment efficiencies, with their associated higher first costs, have been the many incentive programs launched by summer-peaking electric utilities seeking to postpone the addition of more generating capacity. They find it less expensive to pay a homeowner or contractor $300 to $600 for installing high-efficiency equipment than to pay up to $1,500 a peak kilowatt for new power plants.

Because of these incentives, homeowners have been recovering a large portion of the first-cost premium for high-efficiency equipment. In fact, industry shipment statistics indicate that more than a few have been replacing inefficienct equipment in good working order so they can lower their operating costs.

In 1985, more than 50 electric utilities were offering incentives of some type. We think that number is somewhat less today because, even though some utilities are still joining the program, a greater number are withdrawing after accomplishing their mission. Too, some have stated that market trends indicate homeowners are opting for high efficiency without incentives.

The number of gas utilities offering incentives is much smaller and, for the most part, they have taken the form of low- or no-interest loans for high-efficiency equipment. The fuel oil and LP gas industries, to the best of our knowledge, do not and have not offered any incentives.

As some utilities already have noted, there are strong indications that homeowners do not always require monetary incentives or mandatory minimum efficiencies to make a wise choice.

This notion is supported by the overall record of the comfort cooling and heat pump markets, which show higher average efficiencies than incentives or regulations can explain, and by the record of the comfort heating market over the five years since high-efficiency equipment has become

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widely available. Remember, too, that the shift in heating efficiencies came with little or no help from the utilities.

Room units

The Association of Home Appliance Manufacturers (AHAM) reported that an average room air conditioner shipped in 1985 used 21.8% less energy, or 279.4 fewer kWh/year, than its counterpart shipped in 1972. The comparison is based on an arbitrary 750 annual hours of operation. Depending on where they live, U.S. homeowners can expect to use their room units from 150 to 2,250 hours each year.

The most energy-efficient room units — those with EER's of 8.5 or more — accounted for 39.2% of domestic shipments in 1985, up dramatically from 11.4% in five years earlier. Similarly, room units with EER's of less than 6.5 accounted for 36.9% of shipments in 1980 and only 18.4% of shipments in 1985.

In between, room units with EER's of from 6.5 to 7.4 accounted for 16% of 1985 shipments, down from 20.6% in 1980. And those with EER's of from 7.5 to 8.4 accounted for 26.4% of shipments in 1985, down from 31.1% five years earlier.

Over the years, room air conditioners have steadily given way to central air conditioning as a preferred way to provide comfort cooling. When electricity prices jumped upward, some felt people would revert back to cooling only part of a home in order to save operating costs. If it happened, it didn't happen often enough to affect a room unit market that today is only half its former size.

A hard dollar and stiff Japanese competition in world markets also helped whittle room unit shipments to a point where they were the only disappointment in AHAM's banner year in 1986.

Other measures

Of little market value, in our opinion, have been the residential conservation service (RCS) home energy audit programs offered by many utilities either free or for a token charge. Testimony before Congress revealed that many home audits were ordered by middle-income homeowners looking for confirmation — and a pat on the back — for energy conservation steps they had already taken.

Similarly, the fact sheets mandated by the Federal Trade Commission for furnaces and boilers also have been a flop, according to the General Accounting Office. Its survey revealed that 80% of contractors operating in cold climates said they used the fact sheets only occasionally or never. Fact sheets for central air conditioners and heat pumps, although mandated, never were developed.

The winter

Nationally, the October-through-January (1987) heating season has produced below-average temperature-related heating demand, according to the National Oceanic and Atmospheric Administration's (NOAA's) climate impact assessment.

The national residential heating costs for the period were estimated at $26.6 billion, or 2% below normal. The average heating customer's bill nationwide was estimated to be $9 below what it would have been with normal temperatures.

According to NOAA, natural gas consumption was down 48 billion cu ft, or 2%, while electricity (3,064 million kWh) and oil (3.5 million barrels) were each down 3%.

On a regional basis, however, the Southeast experienced a 5% to 10% greater heating demand than normal. It was more than 10% milder than normal in the North Central region. In fact, the South can also look forward to a cool spring.

Internationally, an estimated additional 7 million barrels of heating oil were used because of colder temperatures in January. Western Europe's population-weighted heating degree days were 23% above normal in January, resulting in the use of an extra 13 million barrels of fuel oil. The other biggest users had lower consumption rates. North America was down 6% and Japan was down 9%.

Conservation

Today's new homes use only half as much energy for heating and cooling as they did a decade ago, according to Ralph J. Johnson, president of NAHB Research Foundation. He expects energy use per dwelling to decline by another 25% to 50% during the next decade.

According to a Professional Builder magazine survey, 98% of all home builders reported they are building more energy-efficient homes today than in the mid-1970's. Of these, 90% said their homes are more energy efficient that in 1980, and 70% said they are more efficient than in 1983. In an NAHB survey of homeowners, 68% said energy efficiency would be the most important consideration in choosing a new home.

The Energy Information Administration's (EIA's) 1984 Housing Characteristics, published late in 1986, reported that 59.6% of all households, or 51.5 million homes, were equipped with some form of air conditioning in November, 1984.

Of these, 49.9%, or 25.7 million homes, had central air conditioning and 50.1%, or 25.8 million homes, used one or more room air conditioners (seven of 10 used only one room unit). EIA estimates that 3.1 million homes in 1984 were equipped with heat pumps, or 12.2% of those with central air conditioning. In 1978, only 6.5% of air-conditioned homes used heat pumps.

On a national basis, 22.9% of households used their air conditioners all summer, 20.1% used them quite a lot, 42.6% used them a few times, 6.2% didn't use their air conditioners at all, and 8.1% did not live in their homes during the summer of 1984.

As might be expected, more households in the highest income group ($35,000 or more) used their air conditioners all summer (31.5%) than in the lower income groups. Central air conditioners were used in 66% of homes in the highest income group versus only 44% for all other groups.

There was no evidence that high-income families keep their homes cooler than those with lower incomes. The national average setpoint in the conditioned space was 73.1°F. Geography, however, did make a difference. Homes in the South averaged a 75° setpoint while those in the North, with a much shorter cooling season, opted for 71°.

In addition to central and room air conditioners and heat pumps, EIA reported that 3.8% of U.S. homes use evaporative coolers, 7.8% use whole-house cooling fans, and 35.8% use window or ceiling fans.

Budget plans for the payment of energy bills are available from 63% of electric utilities, 72% of gas utilities, 60% of LP gas suppliers, and 65% of fuel oil suppliers. However, only 5.5% of electricity customers, 16.9% of natural gas customers, 9.2% of LP gas customers, and 15.1% of fuel oil customers use these budget plans.

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made by 93% of electricity users, 94% of LP gas users, 83% of natural gas users, and 69% of fuel oil users.

EIA estimates that, of the 21.7 million natural gas forced-air furnaces installed in U.S. homes in 1984, four of 10 (40.6%) are at least 15 years old.

Other heating equipment, in numbers of units with the percentage at least 15 years old in parentheses, are: 600,000 (78.3%) natural gas gravity furnaces; 3,800,000 (61.1%) natural gas floor, wall, and pipeless furnaces; 3 million (58.5%) oil-fired boilers; 3,300,000 (49.3%) oil-fired furnaces; 3 million (48.8%) gas-fired boilers; 2,800,000 (40.8%) built-in electric systems; 900,000 (40.1%) LP gas room heaters; 3 million (33%) natural gas room heaters; 1,200,000 (33%) LP gas furnaces; 2,500,000 (12.9%) electric furnaces; 2,300,000 (9.8%) heat pumps; and 5,200,000 (9%) wood stoves.

According to the report, tax credits did not provide a significant incentive for energy conservation. EIA reported only 17% of homeowners claimed an energy conservation tax credit in 1984 and, of those, 88% said they would have made the improvements anyway. If the 5% who took the maximum credit in previous years are added, only one in five used the credits.

Among the conservation improvements made in 1984, a total of 17.5 million households added caulking, 1 million added an automatic or setback thermostat, 1.2 million insulated hot and cold water pipes, 1.2 million added a wood stove, 800,000 insulated heating and cooling ductwork, 700,000 added electronic furnace ignition, 300,000 added vent dampers, 300,000 added flame retention-head oil burners, and 200,000 added a heat pump.

Natural gas accounted for 55.4% of all principal heating systems in 1984. These included warm air furnaces (33.9%), hydronic systems (10.1%), floor, wall, or pipeless furnaces (6.5%), and other systems, including room heaters (4.95).

Electricity accounted for 16.8% of systems. These included built-in units (6.3%), electric warm-air furnaces (6%), heat pumps (3.6%), and other (0.9%). Fuel oil accounted for a 12.4% share. These included hydronic systems (7.3%), warm air furnaces (4.7%), and other oil-fired equipment (0.5%).

Wood accounted for 7.5% of principal heating systems, including 6.6% which were wood stoves and 0.9% other systems. LP gas accounted for a 4.5% share. These included warm air furnaces (2.7%), room heaters (1.2%), and other types (0.7%). Kerosene heaters accounted for 1.7% of principal heating systems.

More than four of 10 (41.1%) of homes in 1984 used a secondary fuel source. Principal among these were wood (20.1%), electricity (14.1%), and fuel oil or kerosene (7.1%).

1986 housing characteristics

In keeping with our practice of past years, The News has obtained from the Bureau of the Census the characteristics of new homes completed during the first nine months of the previous year. The accompanying table on page 90 contains both national statistics and, because these figures have an annoying habit of clouding local experience, an added regional breakdown.

It's important to note that these figures are for reported home unit completions and not for home starts, which are reported elsewhere in this issue. The total number of completions, therefore, are not statistically important. The ratios are.

Looking at fuels for single-family homes, the gas share increased from 43.4% in 1985 to 46.8% in 1986. Oil's share also increased from 2.6% to 4.1% in the same time frame. Both gains were at the expense of electricity, which declined from 49.9% in 1985 to 45.6% last year, and other fuels, which declined from 4.1% to 3.6%.

The story was much the same in the multifamily sector. The gas share increased from 30.2% in 1985 to 33.4% in 1986, oil increased from 0.2% in 1985 to 1.3% last year, and electricity's share declined from 68.7% in 1985 to 64.5% last year. The "other" fuel share stayed constant at 0.9%.

The shift, we feel, is both a result of geography and a reaction to fuel prices. Growth in the Northeast and North Central housing markets, particularly among multifamily units, and a corresponding decline in the South meant that fewer heat pumps and electric resistance heating systems were used.

At the same time, the sharp decline in the price of fuel oil showed up directly in market share increases for this fuel although, admittedly, the base is small. The use of other fuels, which include wood, LP gas, kerosene, coal, and solar, would appear to have peaked and, today, are on their way downward in terms of new construction.

The penetration of air conditioning in single-family homes in 1986 was 69.9%, down a hair from the 70.3% recorded a year earlier. Air conditioning penetration in multifamily units held steady last year at 87.8%. Here again, the decline in the South's share of market had an influence.

Significantly, the penetration of central air conditioning among single-family homes in the Northeast increased from 41.1% in 1985 to 44% last year. Among multifamily units, the increase in penetration went from 63.6% in the Northeast in 1985 to 81.4% last year. More than nine of 10 single-family homes, and virtually all multifamily units, built in the South now are air conditioned.

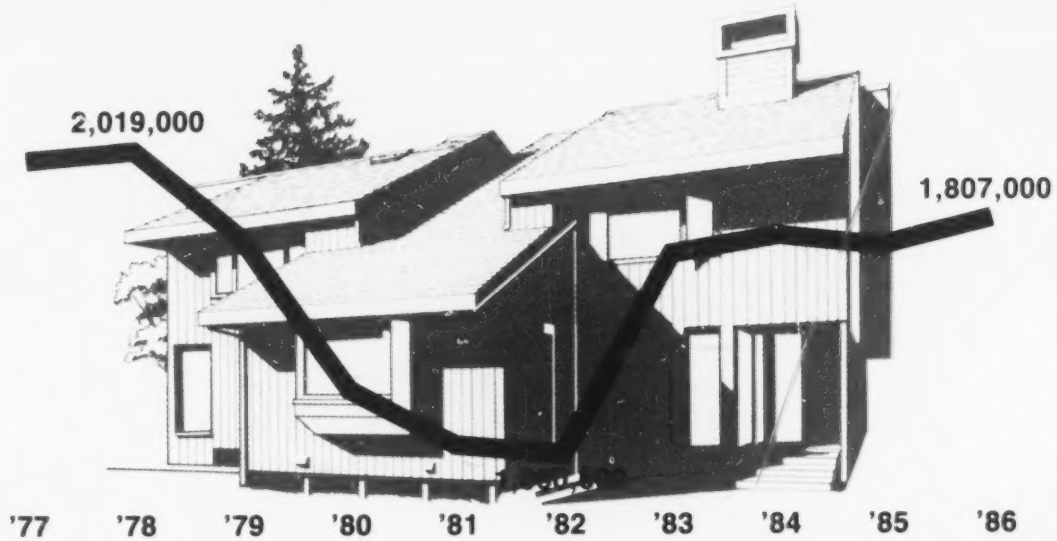
The penetration of heat pumps in single-family homes completed last year slipped to 29% from 30.6% in 1985. Penetration in the South, at 44.8%, remained constant but the heat pump share in the Northeast and North Central regions declined.

Even though a preference for hydronic systems in the North Central states declined a bit from one year to the next, the surge of new-home hydronic systems in the Northeast last year (from 23.5% of all heating systems in 1985 to 33.6%) moved the hydronic national market share from 4.3% in 1985 to 6.3% in 1986.

The warm air furnace share of new single-family homes, at 54.6%, remained constant. It's perhaps noteworthy that warm air furnaces account for only a third of new single-family homes built in the Northeast and less than half of those in the South. But more than eight of 10 new homes (83.2%) built in the North Central states are equipped with warm air furnaces.

Each Statistical Panorama includes the latest data available. Sources frequently revise their previous year's figures, which explains apparent discrepancies between the latest and earlier published data. Where sources give significantly varying information, that data is mentioned.

HOUSING AND CONSTRUCTION



Conventional Housing

Housing starts last year pushed upward by 3.7% on the strength of single-family homes and the last vestiges of a miniboom in multifamily units. It was the best year for housing since 1978 and a far cry from the depressed figures posted in the recession era of 1981 and 1982.

The housing market in 1986 was one of contrasts. The Northeast and Midwest, long the weaklings, showed the most growth while the West marked time and the once-burgeoning South registered its third decline in as many years.

The strength and regionality of the single-family market promises to continue, even if not quite so robust. The multifamily condominium market, too, is stable, but the rental market is in disarray. It's a victim of tax law changes and prior tax shelter-inspired overbuilding that has pushed vacancy rates well beyond reasonable limits.

1986 experience

Private housing starts in 1986, at 1,806,600 units, represented a 3.7% improvement over the previous year's performance and the best year for housing since 1978. The total for 1985 was 1,741,900 units.

It was a year of contrasts and, because of changes wrought by the new tax law, not without its troubles. Many of the strongest markets of only a few years ago have become the weakest and vice versa. Single-family home construction continued strong but an overbuilt rental apartment market peaked early in the year and has been in trouble ever since.

It was a good year for the Northeast, which has long been one of housing's weak sisters. Starts were up 17% in 1986, the fourth increase in as many years and the most starts since 1972. The 246,000 new housing units represented a 16.3% share of the national market, the highest share since 1967.

In the Midwest, despite problems on the farm and layoffs in industry, housing starts were up 23%. Its identical 16.3% share of the national market was the Midwest's best showing since 1979.

Housing starts in the West last year, at 484,000 units, were up 3% thanks to nearly 300,000 starts in California alone. Its market share stands at 26.8%. Several of the other states, however, are hurting.

The South, which as late as 1983 enjoyed a 56% share of the national housing market, witnessed its third decline in a row last year. The drop was 6% in 1986 to 733,000 units. Its 40.6% market share was the lowest since 1977.

Single-family home starts in 1986 totaled 1,179,400 units, an increase of 10% over the 1,072,400 single-family starts in the previous year. Last year's total was also 11% above the total for the whole housing market in the recession year of 1982 It was also the fourth year in a row when this sector topped the one million mark.

Multifamily home starts last year, at 627,300 units, experienced a decline of 6.3% from the 1985 total of 669,500 units. That figure, however, is somewhat misleading. Because of the sudden weakness of the rental apartment construction market, multifamily home construction peaked in the first quarter of 1986. For the rest of the year the decline was more like 10%. And,

as we shall see, the worst is yet to come.

1987 forecast

The demand for single-family homes is still with us even if, as in the past two years, its strength is somewhat regional. Affordability has improved substantially with lower mortgage rates. And demand has been helped by the fact more and more baby boomers are entering the market.

There are regional differences. The Northeast should continue strong even though land assembly is becoming more difficult in this heavily populated area. The Midwest, too, should approach last year's level. Much of the activity, however, will be confined to the more industrialized areas rather than the still-depressed farm country.

The West, helped in large measure by California, should not decline by much. And the South, only four years ago the brightest jewel in housing's crown, probably will slip back again in 1987. But not by much. The strength in Florida and the Carolinas just isn't great enough to overcome the continuing problems in the oil-producing states of Oklahoma, Louisiana, and Texas.

On balance, then, single-family housing starts this year should hold at 1,135,000 units, or 3.8% lower than in 1986.

The multifamily market is another story. The boom in rental apartment construction in 1984 and 1985 — which makes up nearly three-quarters of that market — was partly artificial. It was fueled by the availability of tax-exempt bonds and tax shelter-oriented syndicates with a commitment to build whether or not there was demand.

The new tax law wrecked the base on which the tax shelters were built. The promise of that legislation also dried up the supply of tax-exempt bond financing for multifamily construction. It amounted to $20 billion in 1985 and disappeared almost completely last year.

The result is a national vacancy rate of 7.5% for rental apartments, nearly 11% in the South. It promises to get worse as more tax shelter-financed apartment projects are completed this year. Its effect is a surplus of about 500,000 rental apartments that will take four to five years to absorb.

It should be said, however, that the for-sale condominium and apartment

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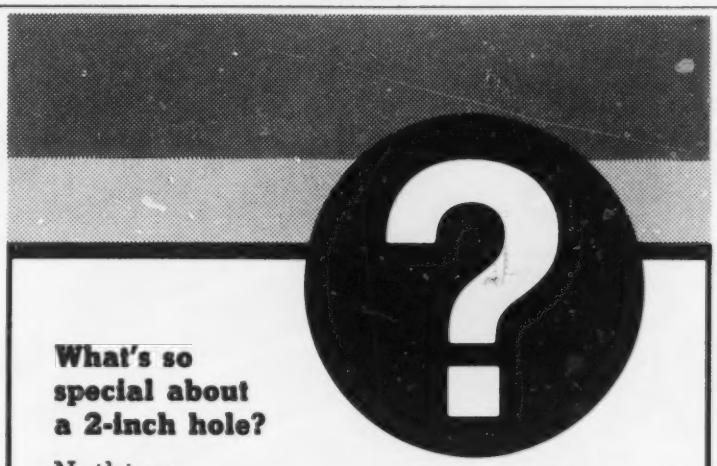

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FROM PRECEDING PAGE

market, at 26% of the multifamily market, has been solid and should continue so. This is particularly true in the Northeast where escalating land values have pushed the prices of single-family homes over the horizon for many.

Because of these rental apartment troubles, the multifamily market probably will decline by 24% this year to 475,000 units. That's 157,300 units less than in 1986.

Taken together, then, private housing starts this year should total 1,610,000 units. That's an 11% decline from last year's performance. Most, however, will find little difference because, since the first quarter of 1986, that's about how housing has been performing.

Looking ahead even further, the National Association of Home Builders estimates that housing starts will average about 1.6 million units for the rest of the decade.

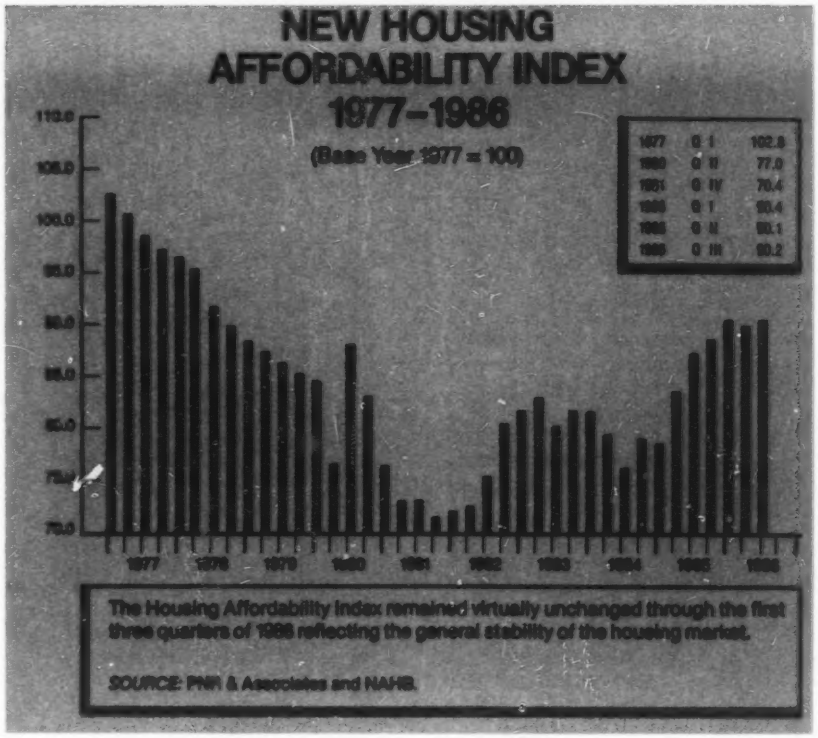
The top 20

Home construction in the top 90 metropolitan areas is not expected to do quite as well in 1987 as in the country as a whole. The detail illustrated in NAHB's top 20 markets illustrates this fact and underlines the wide disparity between different regions of the country.

The Dallas-Fort Worth market, in first place in 1984, has slipped to eighth and is second only to Phoenix in rate of decline in 1987. Houston didn't make the list again this year.

The 1986 records of the leaders, with 1987 expectations in parentheses, follow:

Los Angeles-Anaheim-Riverside 128,000 (128,000); Atlanta 55,280 (49,755); Chicago 36,490 (38,660); San Diego 37,520 (35,200); San Francisco-Oakland-San Jose 40,100 (35,000); Washington, D.C. 36,100 (34,100); Phoenix 43,500 (34,000); Dallas-Forth Worth 49,960 (31,860); Tampa-St. Petersburg-Clearwater 31,688 (30,990); Seattle-Tacoma 27,050 (24,350); Detroit 22,744 (22,300); Kansas City 19,700 (22,000); Orlando 25,320 (21,830); West Palm Beach-Boca Raton-Delray Beach 21,830 (20,950); Minneapolis-St. Paul 22,200 (20,000); Baltimore 20,650 (16,890); Nashville 15,815 (16,810); Philadelphia-Trenton-Wilmington 19,699 (16,500); Denver-Boulder 15,845 (15,835); and Ft. Lauderdale-Hollywood-Pompano 17,069 (15,000).


NEW HOUSING AFFORDABILITY INDEX
1977–1986
(Base Year 1977 = 100)
The Housing Affordability Index remained virtually unchanged through the first three quarters of 1986 reflecting the general stability of the housing market.
SOURCE: PNR & Associates and NAHB.

Affordibility

Not since 1978 have homes been affordable by so much of the population. In little more than a year, fixed-rate mortgage rates have declined by 5% to the 9% to 9.5% range, an event that almost doubled the number of families who can qualify for a 90% mortgage on an average-priced new home.

It should be said, however, that credit qualifications have tightened because of the high foreclosure losses over the past five years. Many lenders are requiring a minimum downpayment of 10% and, for those making 5% down payments, they are requiring higher incomes or greater savings.

By way of illustration, a family buying an $85,000 home today with a 10% down payment and a 30-year fixed-rate mortgage would need an income of $31,744 to qualify. That would encompass 21.8 million families, or 35.2%.

Monthly carrying cost, including principal, interest, taxes, and insurance, would be $741. If the interest rate were 17%, its peak only six years ago, monthly payments would be $1,219 and only 7 million families, or 11.4% of all families, would have the required $52,222 annual income to qualify.

The illustration serves two purposes. Not only are there many more qualified buyers in today's market, but the remortgaging of existing homes has become a major market phenomenon.

The $400 billion mortgage origination market last year financed the purchase of new homes, most of the 3.48 million existing homes sold last year, and millions of new mortgages on existing homes to take advantage of the lower rates and reduce monthly payments.

In fact, remortgages accounted for 45% of all mortgage activity last year. But because most of the rush has subsided, remortgages are expected to be only about a third of mortgage originations in 1987.

The availability of mortgage money is ample and promises to stay that way for the forseeable future. Even though rates may drop a few tenths by summer, they are not expected to reach the Veterans Administration guarantee rate of 8.5%. In fact, they may ease up slightly by year's end if inflation builds beyond 3.5%.

Adjustable-rate mortgages, or ARM's as they are called by mortgage bankers, accounted for about a quarter of mortgage originations last year. This is expected to increase to a third in 1987 as

lending institutions step up promotions and increase front-end incentives.

A new market

Just as importantly, a new market has been created by the new tax law. Because installment interest no longer is tax deductible, and interest paid on mortgage loans is deductible, savings institutions are encouraging homeowners to use home equity for major purchases by taking out tax deductible second mortgages.

This market is expected to grow rapidly and could provide important benefits for contractors. It can become an important source of financing for major equipment replacements at rates not available elsewhere.

According to the Federal Home Loan Bank Board, the average price of new and existing homes sold in the third quarter of 1986 ranged from $161,800 in New York City and $159,200 in Washington, D.C., and Los Angeles to $84,000 in Detroit, $80,000 in Pittsburgh, and $68,300 in Louisville, Ky. San Francisco stood alone at the top with an average sale price of $171,400. The average for 32 major cities was $117,300.

Last year's typical homebuyer was 34 years old, married, had a household

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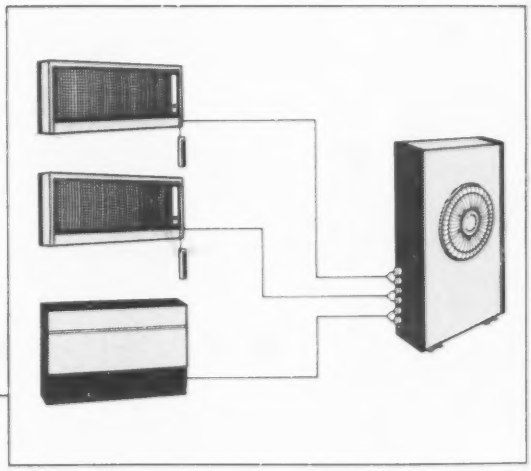

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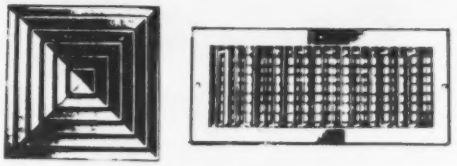

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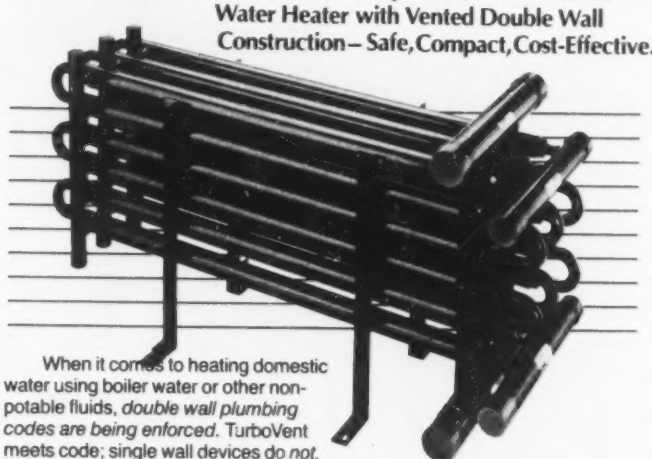

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income of $43,255, bought an $84,480 home, and put 9.2% down. Of the total, 64% of families had two incomes, half (52.6%) were married couples with children (5% were single parents or unrelated individuals, the rest empty nesters), and 36.4% were buying their first home. The median income for a first-time buyer was $37,386, that of a repeat buyer $47,611.

Significantly, 70% of home buyers surveyed by NAHB in 1985 ranked the energy efficiency of the unit an important consideration in the buying decision. For 68%, it would be the most important consideration.

Renters typically have lower incomes than homeowners and the gap is widening. The median income of renters was 65% that of homeowners in 1970 and, by 1983, it had declined to 49%. Of the 29.9 million rental households in the U.S. in 1983, a third consisted of one person and two thirds contained no more than two people. Of the total, 61% were in structures with fewer than five units, and 16.7% were in buildings with 20 or more units.

NAHB reported that, in 1986, about 15% of the single-family home starts were townhouses, about half fee-simple townhouses and half townhouse condominiums. Of the multifamily homes completed last year, 26% were for-sale apartments and condominiums. That's a 3% increase over the 1985 experience.

Demographics

The widening disparity of annual income between renters and home buyers, when combined with demographics, spells additional trouble for the multifamily rental market. The nation's household growth is slowing, a trend that's expected to last through the end of the century.

The growth of households averaged 1.7 million annually through the 1970's, slowed to about 1 million/year during the early 1980's because of high interest rates and a recession, and rebounded to an annual rate today of 1.5 million.

This rate should hold for the rest of the decade and then drop to the 1.2- to 1.3-million range, according to the Harvard-MIT Joint Center for Urban Study. Those aged 35 to 44, the prime home-buying group, will increase through 1990 and, again, through the year 2000. Studies of marriage and divorce trends indicate the growth of married couples will be greater than normal.

The population 65 years old and

older will continue to increase through the turn of the century. But the 25- to 34-year-old age group will decline throughout the 1980's and turn negative in the 1990's. The 18- to 24-year-old age group already has peaked and will decline by 15% in this decade.

This is bad news for apartment developers. Not only do they face an oversupply situation that will take them into the 1990's to absorb, but the two age groups that make up their prime market will be in decline. It also comes at a time when tax incentives have disappeared and real estate appreciation rates are much less. And renters, who have lower incomes, will face much higher rents if apartment owners are to make up at least part of their lost income.

Despite present home building trends, demographers forecast a continuing population and employment flow from the Northeast and Midwest to the South and West for the rest of the century. They say the West will grow by 22% in the decade of the 1980's, 18% in the 1990's. The South's population will grow by 15% in the 1980's, 13% in the 1990's. The shift to nonmetropolitan areas, which slowed in the 1980's because of the recession and its aftermath, is expected to resume.

Remodelling

Additions and alterations, including comfort equipment major repairs and replacements, account for a major share of the total value of residential construction activity. Over the past 20 years additions and alterations alone have accounted for 16% to 32% of residential construction, according to NAHB. The value of improvements tends to be higher in recessionary periods.

The $17.6 billion total for alterations in 1985 represents a continuation of a steady increase in that market since 1982. This is in addition to the $16.1 billion spent in 1985 for the repair and replacement of major systems or equipment such as heating and air conditioning systems.

Mobile homes

Shipments of mobile or manufactured homes in 1986 totaled 244,660 units, a decline of 13.7% from the prior-year total of 283,489 units, according to the National Conference of States on Building Codes and Standards (NCSBCS).

Shipments of these site-delivered homes, popular with retired people and those with moderate incomes, are not counted in the official housing statistics. In 1986 these mobile homes amounted to 20.7% of private single-family site-built homes, down from 26.6% in 1985. They compare to 36% in recession-ridden 1982.

As with conventional housing, the Northeast (up 8.1%) and the East North Central states (up 8.5%) were the strongest markets last year. The South Central (down 29.6%) and the South Atlantic (down 14.6%) fared the worst. The other markets were down from 4% to 11%.

The product mix in 1986 was 62.7% single-section homes and 37.3% multisection homes, according to the Manufactured Housing Institute (MHA). The 1985 split was 67%-33% in favor of single-section homes.

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For the fourth year in a row, the average first-year settlement in construction contracts reported to the Construction Labor Research Council (CLRC) in 1986 was less than 2.5% or 50 cents an hour.

The average first-year increase last year was 48 cents an hour, or 2.3%. If the impact of contract language changes designed to reduce overall labor costs is included, the average increase would be more like 38 cents an hour.

The average second-year increase in multiyear contracts was 58 cents an hour, or 2.8%. Although higher than first-year increases negotiated in 1986, the second-year amounts were, on average, the lowest since CLRC began reporting on negotiation results in the mid-1970's. In fact, the average second-year increase has declined each year since 1981.

CLRC pointed out that, as recently as 1981, construction wage settlements averaged 12%.

The higher first-year increase in 1986, when compared to the 34 cents/hour or 1.6% average in 1985, is the result of fewer wage rollbacks and wage freezes last year, the Council reported. Among the unions of most interest to this industry, for example, there were 23 wage freezes and only six wage rollbacks among the 106 contracts negotiated in 1986.

In recent years, increases have been disproportionately channeled into fringe benefits. In 1986, however, most of the money was allocated to wages as the amounts negotiated for fringe funds declined both absolutely and as a percentage of the total increase.

CLRC reported that all regions, with the exception of the Southwest Pacific (Arizona, California, Hawaii, and Nevada) and Mountain-Northern Plains (Colorado, Montana, North and South Dakota, Utah, and Wyoming), experienced higher wage settlements last year than in 1985.

Even though the South Central region (Arkansas, Louisiana, New Mexico, Oklahoma, and Texas) had the smallest average increases, the average in 1986 was more than 50 cents an hour higher than in 1985. Both New England and the Middle Atlantic states had settlements much higher than the national average.

One-year contracts continue to be the most common but an earlier trend toward longer contracts continued in 1986, according to CLRC. Contracts covering larger numbers of workers tend to be for more than one year. On the other hand, almost all contracts negotiated in the South Central region were one-year documents.

In some agreements, increases in wages and fringes were offset by contract language changes that produced average savings amounting to 45 cents/hour.

One of the most frequent changes was a reduction in the overtime premium from double the base rate to 1.5 times that rate for some or all of daily and Saturday overtime. Other changes included permission for four 10-hour days, a Saturday make-up day, reduced or eliminated travel pay, and the elimination of premium payments for a wide range of miscellaneous situations.

Among the crafts, settlements for carpenters and laborers got the biggest increases and, in fact, they accounted for almost all of the increase in the national average last year. Bricklayers and cement masons also were noteworthy for their higher-than-average settlements.

CLRC reported that construction employment increased by 5% last year and, for the first time in history, totaled more than 5 million. But after hovering in the 13% range for nearly two years, construction unemployment jumped to more than 15% in the last two months of the year.

The council's report covers 808 construction labor agreements negotiated in 1986 on behalf of 666,696 workers. The settlements ranged from an average of 99 cents/hour, or 4.8%, in New England to zero in Texas.

The 61 contracts negotiated by plumber and pipefitter United Association (UA) locals covered 44,623 workers. The average first-year settlement, in wages and fringes, was 62 cents/hour, or 2.7%. In the case of 26 multiyear contracts covering 15,872 workers, the average second-year settlement was 64 cents/hour or 2.7%.

Only one contract contained a cost-of-living adjustment (COLA). Of the total, one agreement called for a first-year increase of more than $1.40/hour and eight called for increases in the range of $ to $1.19/hour. Twelve agreements produced no increases and four others showed a net decline.

The 45 contracts negotiated by the Sheet Metal Workers' International Association (SMWIA) covered 29,028 workers. The average first-year settlement, in wages and fringes, was 57 cents/hour or 2.7%. In the case of the 24 multiyear contracts covering 19,535 workers, the second-year increase averaged 79 cents/hour or 3.3%.

Here again, only one contract contained a COLA provision. Of the total, four agreements called for a first-year settlement of more than $1.40/hour, one called for a settlement of between $1.20 and $1.39/hour, and eight called for settlements of between $1 and $1.19/hour. A dozen agreements produced no increases and two others showed a net decline.

On the open shop side, Associated Builders and Contractors (ABC) president John C. Jones reported that overall construction volume should be down slightly in 1987. Commercial retail construction should improve this year, he explained, but will be overpowered by declines in office building, industrial construction, and public works.

Early in 1987 the National Constructors Association (NCA) and the AFL-CIO's Building and Construction Trades Department signed a National Construction Stabilization Agreement which promises to change how the big design/build contractors handle industrial and power plant construction projects.

The agreement does not incorporate any terms of local labor contracts, including wages, but it requires contractors to use existing union hiring halls. It prohibits the subcontracting of any on-site work to any nonsignatory contractors.

Interestingly, the agreement calls for the union to pay the owner a fine of $10,000 per shift in liquidated damages if an arbitrator determines that a work stoppage or slowdown violated its broad no-strike provisions. The union would not be held liable, however, if the general president used his best efforts to get local union members back to work.

The ban on strikes and lockouts allows for the support of local collective bargaining. However, contractors can select and hire all supervisors, designate working foremen, and coffee breaks, travel and subsistence pay, and overtime were virtually eliminated.

Wage rates, alteration of the work week, and the number of apprentices and subjourneymen will be determined by a joint administrative council. The agreement provides an expedited grievance procedure.

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INTERNATIONAL

Even though the value of U.S. air conditioning and refrigeration equipment exports in 1986 amounted to 134% of imports, the positive trade balance that approached $2 billion as late as 1978 eroded by almost half last year to $337.8 million.

The picture was worse for heating equipment. A negative trade balance of $86.8 million in 1986 represented a 5.6% increase over the prior year. Imports held about even but exports declined by 3.2%.

There are many reasons for the growing influence of imports. Although the value of the U.S. dollar in world markets has dropped by 40% against the Japanese yen and 25% against the German mark, it has not declined by nearly that much against other currencies. The relationship between the currencies of the U.S. and Canada, its best customer for air conditioning and refrigeration equipment, was relatively unchanged.

The dollar's decline against the yen probably will have an effect in time but, in 1986, it was not apparent. Imports from Japan last year, at $547.3 million, represented 55.1% of all air conditioning and refrigeration imports. U.S. exports to Japan totaled only $52.2 million.

The U.S. negative trade balance with Japan has advanced steadily from $283.2 million in 1984 to $402.7 million in 1985 and $495.1 million last year.

In Japan, the business community is fearful that, if the Japan-U.S. trade imbalance increases much more, the yen will fall further against the dollar. If that happens, they said it would all but stall Japan's economic growth. They are suggesting voluntary export quotas, a move the Japanese government does not support.

Japanese firms to date have absorbed much of the difference in hopes the yen will stabilize. They are seeking less expensive components in the world market to reduce the cost of their finished products. They're seeking offshore production sites. And, considering the wave of protectionism in the U.S., considering the establishment of U.S. assembly or production facilities.

Meanwhile, U.S. manufacturers have shown an increasing tendency to source components, particularly compressors, from abroad. Several have indicated, however, they would prefer to buy domestic rotary compressors when they are available in quantity. Many big-system components for the world market have been made in U.S. subsidiary plants abroad to escape the hard dollar penalty. This year should provide an indicator of how these markets will lean in the future.

Looking across international markets, the economies of Europe are expanding, but those in the Far East, including Japan, are slowing. However, Taiwan continues to lead all countries with a 19% growth rate, followed by France at 11%.

The Middle East, still torn by war and dissension over oil prices, is a shadow of its former potential for this industry's goods. The bright spot is Saudi Arabia, which last year greatly increased its oil exports to the U.S.

Trade balance

The total value of U.S. air conditioning and refrigeration exports, according to the Department of Commerce, was $1,330,977,660 in 1986, down 5.9% from the $1,413,837,032 total in the previous year. In 1981, U.S. exports totaled $2 billion.

At the same time, the $993,173,627 worth of air conditioning and refrigeration equipment imported into the U.S. last year was up 34.7% over the $766,766,254 total for 1985. In 1981, imports totaled $273.8 million.

Imports represented 74.6% of exports last year, up from 54.2% in 1985 and far higher than the 13.2% recorded in 1981. The biggest shift has been the exponential increase in the number of imported compressors. The U.S. imported 10.3 million compressors last year worth $437 million, up 9.8% from the $398.2 million worth of compressors imported the previous year.

Major export markets

U.S. air conditioning, refrigeration equipment (values in millions)

Market	— 1982 —		— 1983 —		— 1984 —		— 1985 —		— 1986 —	
	Value	% of total	Value	% of total	Value	% of total	Value	% of total	Value	% of total
Canada	352	19	422	27	530	33	534	38	459	34
Central, South America	285	16	180	12	211	13	193	14	234	18
Western Europe	323	18	277	18	290	18	236	16	251	19
Far East	297	16	242	15	247	15	225	16	217	16
Middle East	445	25	361	23	266	17	175	12	140	11
Africa	98	5	51	3	48	3	41	3	28	2
[illegible]	1	[illegible]	33	[illegible]	11	[illegible]	19	1	2	0

The positive balance of trade generated by air conditioning and refrigeration equipment amounted to $337.8 million in 1986, down 47.8% from the $647 million positive balance in the previous year. The positive trade balance in 1981 was $1.8 billion.

It must be remembered that these figures only represent shipments. They do not take into account the profits of U.S. companies from subsidiaries, joint ventures, and from licensing agreements that are not reinvested abroad.

In 1986, for the fourth year in a row, Canada was the leading export market for U.S. air conditioning and refrigeration products. The $459 million worth of exports to Canada, or 34% of the total, was down significantly from the $534 million total of the previous year.

The Middle East, which had been the leading export market for many years, accounted for only 11% of the total, or $140 million, last year. This market dropped in both dollar volume and share of the export market.

Western Europe's share of the U.S. export market climbed from 16% to 19% last year. Exports to that region also increased from $235.8 million to $251 million. Exports to Central and South America increased from $192.9 million in 1985 to $234 million last year and its share of the export market increased from 14% to 18%.

The Far East absorbed $217 million in U.S. exports last year, down from $224.9 million in 1985. Its share stayed constant at 16%. Exports to Africa, at $28 million last year, dropped from $41 million in 1985. Its share of U.S. exports dropped from 3% to 2%.

Imports

According to the Department of Commerce, eight nations accounted for 92.5% of the $993,173,627 worth of air conditioning and refrigeration equipment and components imported into the U.S. in 1986. The total represents a 34.7% increase over the 1985 total of $766,766,254. The eight:

• **$547 million from Japan,** up 20.8% from $453 million in 1985, which mostly included 5.9 million compressors (up 9.3%) – including 1.5 million compressors of less than 0.25 hp; 3 million auto air conditioning compressors; 990,000 compressors of from 0.25 to 1 hp; and 244,000 compressors of from 1 to 3 hp – 96,000 room air conditioners; 6,900 heat pumps; 406,600 air conditioning condensing units; 1,800 refrigerators; 8,900 absorption refrigerators; 8,400 freezers; 575 refrigerated display cases; $173.4 million in auto air conditioners and parts; $6.4 million in air conditioning machine parts; and $672,000 in heat pump parts.

• **$80.5 million from Italy,** up 25.4% from $64.2 million in 1985, which mostly included 1.7 million compressors – including 864,000 compressors 0.25 hp and under; 381,600 compressors rated at 0.25 to 1 hp; and 442,900 compressors of from 1 to 3 hp – 500 room air conditioners; 350 air conditioning condensing units; 5,600 refrigerators; 9,700 absorption refrigerators; 7,000 refrigerated display cases; and 76,400 freezers.

• **$66.6 million from Brazil,** up 76.2% from $37.8 million in 1985, which mostly included 1.3 million compressors – including 980,000 of 0.25 hp and under, and 288,000 of from 0.25 hp to 1 hp – 174,000 room air conditioners; 7,300 refrigerators; 1,800 absorption refrigerators; 2,300 freezers; and $272,000 worth of air conditioning machine parts.

• **$65 million from Mexico,** up 125.7% from $28.8 million in 1985, which mostly included 60,300 compressors of 0.25 hp and under; 10,800 room air conditioners; 2,500 freezers; 1,600 air conditioning machines; 270 air conditioning condensing units; $31.7 million in air conditioning machine parts; and $26 million in auto air conditioners and parts.

• **$64 million from Canada,** up 3.9% from $61.6 million in 1985, which mostly included 5,000 compressors of 0.25 hp and under; 1,500 room air conditioners; 450 heat pumps; 700 air conditioning condensing units; 88,000 air conditioning machines; 6,800 refrigerators; 33,000 absorption refrigerators; 74,000 freezers; and 1,400 refrigerated display cases.

• **$40.8 million from Sweden,** up 56.9% from $26 million in 1985, which mostly included 82,600 absorption refrigerators; 300 compressors; and $1.35 million in air conditioning machine parts.

• **$28.2 million from Singapore,** down 22.7% from $36.5 million in 1985, which mostly included 490,700 compressors of 0.25 hp and under; 283,500 compressors of from 0.25 hp to 1 hp; 34,500 room air conditioners; 41.4 million in auto air conditioners and parts; and $1 million in air conditioning machine parts.

• **$26.2 million from West Germany,** up 25.4% from $20.9 million in 1985, which mostly included 38,000 compressors of 0.25 hp and under; 335,500 compressors of from 0.25 hp to 1 hp; 2,600 auto air conditioning compressors; 14,800 absorption refrigerators; 1,700 refrigerated display cases; 1,600 air conditioning condensing units; and $1.4 million in air conditioning parts.

Several other countries, while they didn't make the top eight, also had significant exports to the U.S. They included Israel with 26,500 room air conditioners (it was 6,800 a year earlier), Malaysia with 9,500 room air conditioners (it was 4,500 a year earlier), and Korea with 17,200 room air conditioners, 5,700 air conditioning condensing units, 5,700 refrigerators, 2,200 freezers, and 39,300 absorption refrigerators.

Top exports

In terms of products exported from the U.S., the Department of Commerce prepares country-by-country breakdowns for most of the product categories listed in the 10-year look at industry shipments found elsewhere in this issue. In most instances, it lists the total number of units shipped to each country and the total dollar value.

Although we do not have space to provide complete breakdowns, a feel for the top export markets of 1986 can be gained by looking at the top customer countries for key products expressed, unless otherwise indicated, in numbers of units. Here are a few:

Auto and truck refrigeration and air conditioning compressors (152,494 units, down 24% from 200,538 units in 1985): Canada 52,200; West Germany 31,300; Mexico 14,400; Saudi Arabia 9,100; France 6,800; Venezuela 6,600; and Ireland 6,400.

Compressors of 3 hp or less (452,231 units, down 0.3% from

453,596 units in 1985): Canada 120,500; Saudi Arabia 93,900; Mexico 44,200; Thailand 40,000; Venezuela 30,700; and Argentina 23,700.

Compressors of from 3 hp to 10 hp (89,982 units, down 12.7% from 103,086 units in 1985): Mexico 25,000; Thailand 10,400; Canada 10,300; Venezuela 7,800; Australia 6,600; Saudi Arabia 4,500; Kuwait 2,900; and Argentina 2,200.

Compressors of more than 10 hp (42,392 units, up 40.2% from 30,229 units in 1985): Brazil 15,000; Venezuela 8,300; France 3,500; Saudi Arabia 2,300; Canada 2,300; Australia 1,500; and Britain 1,500.

Ammonia compressors (1,887 units, down 6% from 2,008 units in 1985): Colombia 900; Canada 300; Taiwan 200; and Korea 130.

Parts for refrigeration and air conditioning compressors ($33.2 million, up 16.5% from $28.5 million in 1985): Brazil $5.5 million; Belgium $5 million; Venezuela $3.3 million; Canada $2.8 million; Saudi Arabia $2.4 million; Australia $1.8 million; France $1.4 million; and Mexico $1.5 million.

Room air conditioners under 10,000 Btuh (16,102 units, down 33.3% from 24,129 units in 1985): Hong Kong 3,000; Canada 2,000; Mexico 1,400; Netherlands Antilles 900; Panama 900; and West Germany 700.

Room air conditioners from 10,000 Btuh to 17,000 Btuh (30,317 units, up 2.7% from 29,523 units in 1985): Arab Emirates 5,000; Hong Kong 4,100; Taiwan 2,600; Kuwait 2,100; Canada 1,300; Nigeria 1,000; and Liberia 1,000.

Room air conditioners of more than 17,000 Btuh (17,788 units, down 24.4% from 23,529 units in 1985): Hong Kong 2,800; West Germany 2,300; Britain 1,300; Turkey 1,300; Mexico 1,000; Ghana 800; and Lebanon 700.

Self-contained heat pumps 5 tons and under (13,413 units, up 2.3% from 13,117 units in 1985): Canada 9,300; Japan 1,000; Britain 500; Mexico 300; and Taiwan 300.

Self-contained heat pumps of more than 5 tons (2,373 units, down 11% from 2,667 units in 1985): Canada 1,200; Britain 350; Mexico 350; and Australia 150.

Split-system heat pumps (10,168 units, down 23% from 13,209 units in 1985): Canada 7,600; Dominican Republic 500; Britain 400; Australia 210; and Egypt 100.

All-year heating-cooling packages 5 tons and under (16,977 units, down 25% from 22,725 units in 1985): Canada 13,000; Mexico 1,500; Britain 400; and Bahamas 400.

All-year heating-cooling packages over 5 tons (4,368 units, up 9.3% from 3,996 units in 1985): Canada 3,000; Saudi Arabia 400; Mexico 300; Britain 200; and Arab Emirates 100.

Self-contained air conditioners 5 tons and under (18,031 units, down 22% from 23,077 units in 1985): Canada 6,400; Britain 1,700; Taiwan 900; Mexico 800; Phillipines 800; West Germany 600; Egypt 500; Switzerland 500; and Saudi Arabia 500.

Self-contained air conditioners over 5 tons (9,309 units, down 6.8% from 9,991 units in 1985): Canada 4,500; Saudi Arabia 1,100; France 700; and Britain 500.

Air conditioning condensing units of 5 tons and under (22,857 units, down 37.8% from 36,740 units in 1985): Canada 5,100; Saudi Arabia 1,900; Arab Emirates 1,700; Venezuela 1,500; Nigeria 1,500; France 1,400; and Panama 1,100.

Air conditioning condensing units over 5 tons (5,707 units, down 12% from 6,476 units in 1985): Canada 2,500; Saudi Arabia 1,400; Venezuela 300; and Arab Emirates 300.

Room fan-coil units (13,316 units, down 28.6% from 18,645 units in 1985): Canada 4,000; Saudi Arabia 3,100; Dominican Republic 800; Japan 600; Salvador 400; Mexico 250; and Venezuela 200.

Variable air volume terminal units (4,818 units, down 58.5% from 11,602 units in 1985): Egypt 1,600; Taiwan 800; Canada 600; Australia 400; and Netherlands Antilles 250.

Central-station air handlers (3,646 units, down 8.6% from 3,988 units in 1985): Saudi Arabia 1,500; Egypt 300; Canada 200; Bahamas 200; Venezuela 100; Arab Emirates 100; and Pakistan 100.

Centrifugal liquid chillers (1,154 units, up 7.4% from 1,075 units in 1985): Canada 628; Taiwan 139; Hong Kong 59; Sudan 44; Singapore 43; and Malaysia 33.

Absorption liquid chillers (35 units, down 28.6% from 49 units in 1985): Britain 5; Pakistan 5; Arab Emirates 5; and Netherlands 3.

Reciprocating liquid chilling packages (1,732 units, up 27% from 1,363 units in 1985): Phillipines 430; Saudi Arabia 260; Canada 240; and Japan 130.

Of the $191.8 million in **air conditioning machinery and parts,** down 8.3% from $209.1 million in 1985, Saudi Arabia accounted for $36.8 million, Canada $21 million, Mexico $17.7 million; Venezuela $12.9 million, France $9.7 million, Britain $7 million, West Germany $5.3 million, Japan $4.8 million, Australia $4.7 million, and Hong Kong $4.2 million.

Ice-making machines (18,592 units, up 14.2% from 16,287 units in 1985): Canada 6,340; Equador 2,100; Mexico 930; Britain 735; Japan 660; Haiti 660; Australia 600; and West Germany 590.

Drinking water coolers (74,958 units, down 4.5% from 78,502 units in 1985): Canada 36,600; Saudi Arabia 19,700; Japan 2,500; Indonesia 2,300; Italy 1,700; and Hong Kong 1,500.

Refrigerated self-contained enclosures (24,410 units, up 34.6% from 18,141 units in 1985): Britain 7,600; Canada 4,800; Saudi Arabia 1,500; Japan 1,300; and Jordan 1,100.

Refrigerated enclosures, commercial type (6,054 units, down 24.1% from 7,978 units in 1985): Canada 1,200; Japan 900; Pakistan 500; Mexico 300; Hong Kong 300; Saudi Arabia 240; and West Germany 230.

Heating equipment

Even though information on heating equipment is not quite complete, we thought we would share what could be obtained.

From the scope of the products contained in this report, the value of U.S. heating equipment and parts exports in 1986 totaled $88,369,633, down 3.2% from the $91,302,233 worth exported in the previous year. Imports totaled $175,150,578, down only 0.2% from the total of $175,506,515 worth imported in 1985.

The negative balance of trade for heating equipment last year was $86,780,945, up 5.6% from the negative balance of $82,204,190 in 1985. Exports in 1986 were 50.5% of imports.

The leading export markets for heating products were: Canada $31.7 million; Mexico $6 million; West Germany $5.5 million; Britain $5.2 million; Japan $5 million; Australia $3 million; Belgium, Netherlands, and France, at $2.3 million each.

The U.S. was a primary market for imports from: Japan $49.7 million; Canada $39.7 million; Taiwan $25.5 million; West Germany $12.9 million; Britain $10.7 million; and New Zealand $6.1 million.

Imports

The imports and import leaders:

Fireplace grates ($1,924,614 worth, down 12.4% from $2,197,824 in 1985): Taiwan $1.5 million; China $151,000; Korea $60,000; and France $53,000.

Cast iron stoves and parts ($15,875,353 worth, down 22.6% from $20,522,003 in 1985): Taiwan $7.6 million; Canada $1.5 million; West Germany $1.3 million; Norway $1.2 million; Belgium $1 million; and France $800,000.

Other nonelectric heating apparatus (1,156,687 units, down 34.2% from 1,756,570 units in 1985): Japan 736,300; Taiwan 136,300; Canada 49,400; Britain 42,700; West Germany 27,000; Italy 27,000; and Korea 19,100.

Heating exports

Following are the leading export markets for U.S. heating equipment and parts:

Domestic heating stoves (130,090 units, up 20.4% from 108,089 units in 1985): Canada 114,400; Britain 4,100; Australia 3,600; and Japan 1,600.

Oil and gas burners for central heating (47,950 units, up 151.7% from 19,046 units in 1985): Belgium 15,800; Cayman Islands 8,000; Dominican Republic 5,300; Korea 5,200; Peru 3,100; Netherlands 3,000; Britain 2,200; and Canada 1,800.

Other heating equipment ($15,663,306 worth, up 8.2% from $14,483,453 in 1985): Canada $5.8 million; Britain $1.6 million; Japan $1.3 million; and West Germany $1 million.

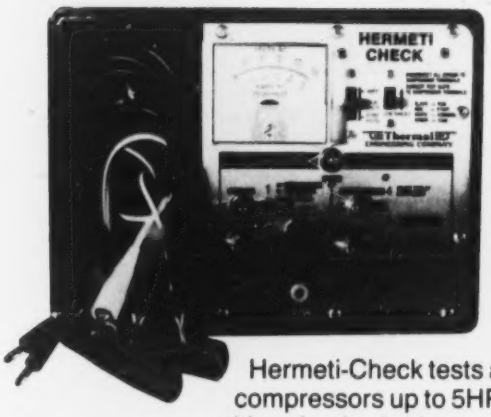
Heating parts ($22,818,174 worth, up 2% from $22,366,948 in 1985): Canada $9.9 million; Mexico $3.8 million; Australia $1.3 million; Britain $1.1 million; and New Zealand $940,000.

Oil burners (15,209 units, up 5.6% from 14,398 units in 1985): Korea 4,500; Canada 4,200; China 600; and Britain 500.

Gas burners (13,503 units, down 6.6% from 14,454 units in 1985): Canada 4,900; Japan 3,300; Britain 1,800; and Mexico 600.

Other industrial burners ($22,824,976 worth, down 23.2% from $29,717,149 in 1985): Canada $5 million; West Germany $3.9 million; France $1.6 million; Japan $1.5 million; China $913,000; Korea $833,000; Saudi Arabia $743,000; and Mexico $714,000.

Each Statistical Panorama includes the latest data available. Sources frequently revise their previous year's figures, which explains apparent discrepancies between the latest and earlier published data. Where sources give significantly varying information, that data is mentioned.



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WHOLESALERS

Air conditioning and refrigeration parts-and-supplies wholesalers report that dollar volume in 1987 should improve over last year's total volume by 8.4%, according to a forecast by 70 members of the Air-Conditioning and Refrigeration Wholesalers (ARW).

The forecasted volume increase varies for the five regions of the U.S. from a gain of 5.5% in the Central region and 5.6% in the Southwest to 11% in both the Southeast and West. The expected increase in the Northeast was pegged at 7.8%.

Wholesalers expect inflation this year to average only 2.6% in the U.S. (the median forecast is 3%) but, in Canada, wholesalers expect the inflation increase to average 4.9% (a median of 4%).

Over past years ARW has kept a record of how its forecasts have matched up with actual experience. Here are the forecasts for the previous five years together with the actual sales performance for that year in parentheses: 1985 — 9% (4%); 1984 — 9.5% (14.1%); 1983 — 11.5% (12.6%); 1982 — 7.4% (2.2%); and 1981 — 10.2% (8.5%).

The 1987 forecast was conducted with the assistance of the Profit Planning Group, a Boulder, Colo., consulting firm, under the auspices of ARW's Marketing and Statistical Committee.

It should be noted, also, that sales volume responses have been weighted to more accurately take into account the fact that wholesalers vary widely in both size and location. For example, a firm with $20 million in sales that projects a 10% increase would be given twice the value, or weight, of a firm with $10 million in volume projecting the same increase.

Because ARW wholesalers have traditionally been oriented toward parts and pieces, their business depends much more on the number of system repairs being made in a given year than on the much more volatile new construction equipment market. For this reason ARW members tend to experience flat sales during recession years, rather than declines, and lesser gains in boom years.

For example, when unitary shipments declined by 21% in 1982, ARW-member volume increased by 2.2% and, when unitary shipments rebounded by 43% a year later, the increase for ARW wholesalers was a more modest 12.6%.

Looking across the national forecasts, there are no anticipated sharp increases again this year. The biggest increase, at 9.7%, is in residential unitary equipment — largely because of an expected 17.2% gain in this category by wholesalers in the Southeast.

Other healthy increases are expected for replacement compressors (8.4%) and electric motors (7.4%). At the low end of the spectrum are refrigerants (up 2.5%), refrigerant flow controls (4.1%), and grilles, registers, and diffusers (4.2%).

The regions

On a regional basis, wholesalers in the Southeast expect an 11% sales increase this year. It appears to be reflected in both the construction and replacement markets. In addition to the previously mentioned small unitary gain, they expect a 10.3% increase for replacement compressors, a 9.5% increase for pipe and tubing insulation, a 9.4% increase for electric motors, 9.2% gains for refrigeration coils and sheet metal and fittings, and a 9.1% increase for instruments and test equipment.

The West also expects an 11% increase built largely on the repair and replacement business of contractor customers. The big gainers are replacement compressors (9%), electric motors (8.6%), unitary air conditioners of 4 tons and under (7.4%), and larger unitary equipment (7.9%). These wholesalers see no gains for sheet metal and fittings or grilles, registers, and diffusers.

Even though the construction market has rebounded in the Northeast over the past two years, wholesalers in this region see only a 7.8% increase in sales volume in 1987. A 10% increase in sheet metal and fittings is expected but expectations for other product groups are below the national averages. In fact, sales of grilles, registers, and diffusers are expected to decline by 7.6% and sales of refrigerants are expected to drop by 6.2%. These are the only sales declines expected among the five regions.

Both the Central (at 3.5%) and the Southwest (at 5.6%) regions expect only modest increases. The bright spots in these markets are replacement compressors and electric motors and, to a lesser degree, refrigeration coils. Those products associated with new construction are expected to increase at less than national average rates.

Canadian sales in 1987 are expected to increase by 17%, according to the forecasts of 15 wholesalers located north of the border. The forecast reflects a balance between new construction and repair-replacement items.

For example, the market for unitary equipment larger than 4 tons is expected to grow by 14% and the market for smaller unitary equipment should increase by 12.6%. Sales of grilles, registers, and diffusers are expected to grow by 13% and pipe-tubing insulation volume should grow by 12%. Sales of sheet metal and fittings, however, are expected to decline by 9.8%.

Even though compressor replacement sales in Canada are expected to increase by 12.2% this year, sales of electric motors will grow by only half that amount (5.8%). Electrical controls (relays, contactors, starters), however, are expected to show a healthy 13.1% increase.

NHAW

Members of the Northamerican Heating and Airconditioning Wholesalers Association (NHAW) reported that dollar sales in 1986 increased by an average of 8.13% over sales recorded in the previous year. The median increase for the 104 reporting wholesalers in the U.S. and Canada was 6.17%.

NHAW relies more heavily on me-

dians (the number in the middle when individual reports are arranged from low to high) than on averages (the arithmetic mean of all results). To avoid undue confusion, we will stick to median results even though both medians and averages are provided in the organization's reports.

On a national basis, the lower quartile of firms showed zero growth last year while the upper quartile of reporting firms recorded a median gain of 15.4%.

The disparity among regions, however, was significant. It ranged from a median increase of 22.6% in Region 3 (Delaware, Maryland, Virginia, West Virginia, North Carolina, Kentucky, Tennessee, and Washington, D.C.) to a median decrease of 19.67% in Region 8 (Oklahoma, Arkansas, Louisiana, and Texas). Even among the upper quartile of Region 8 firms the decline was 7.7%.

Meaningful gains were made in other regions. The median increase for Region 5 (Indiana, Illinois, Wisconsin) was 13%; in Region 2 (New York, New Jersey, Pennsylvania) it was 12.8%; and in Region 4 (Ohio, Michigan) it was 8.6%. Canada recorded a median increase of 9.5%.

An increase of 5% was reported by wholesalers in Region 6 (Minnesota, Iowa, North and South Dakota, Nebraska, Missouri, and Kansas) and Region 7 (Mississippi, Alabama, Georgis, South Carolina, Florida, and Puerto Rico) reported a 4.4% increase in sales last year.

Two other regions reported sales declines in 1986. Region 12 (Idaho, Alaska, Oregon, and Washington) experienced a median sales drop of 5.8% and Region 10 (California, Nevada, Arizona, and Hawaii) reported a median decline of 1.6%.

In terms of firm size, the disparity was much less pronounced. For example, the median increase for firms with sales of $10 million or more was 7.45%. For firms with sales of from $1 to $2 million, the median increase was 5.6%.

TURN TO PAGE 115

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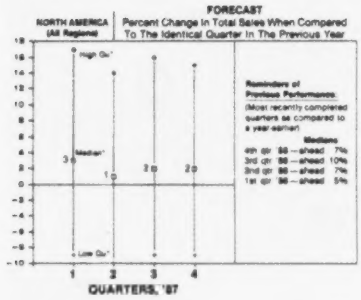
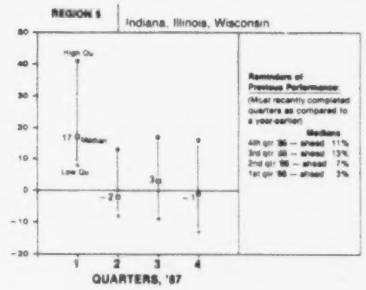
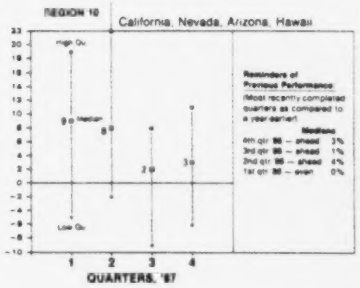
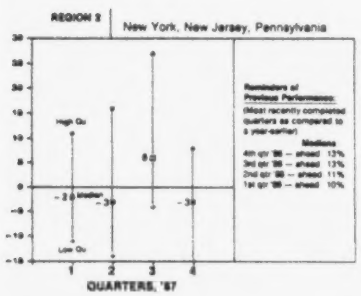
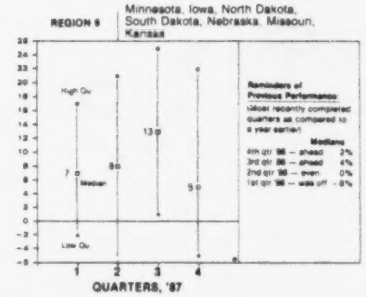
NHAW REGION FORECASTS

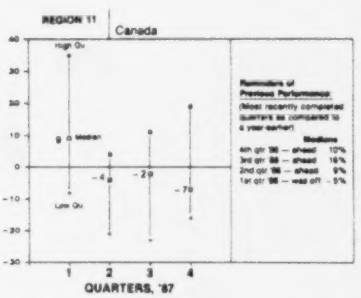

FORECAST
NORTH AMERICA (All Regions)
Percent Change In Total Sales When Compared To The Identical Quarter In The Previous Year
QUARTERS, '87

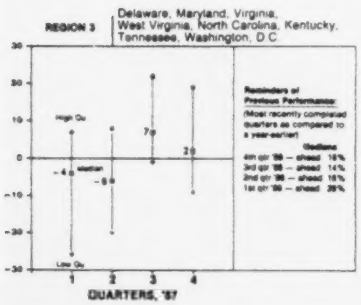


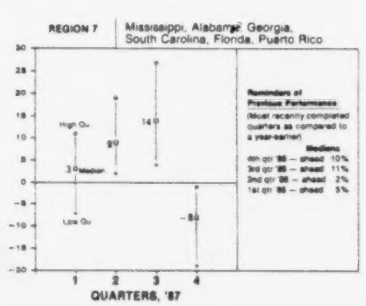


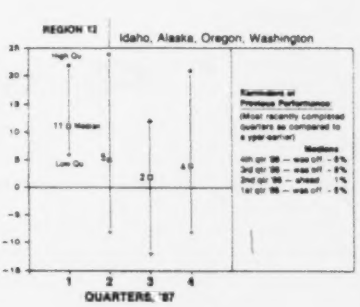


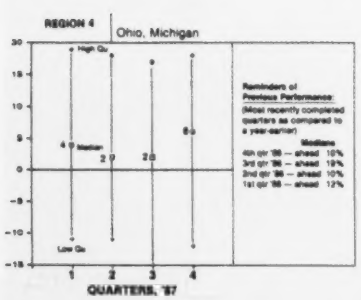


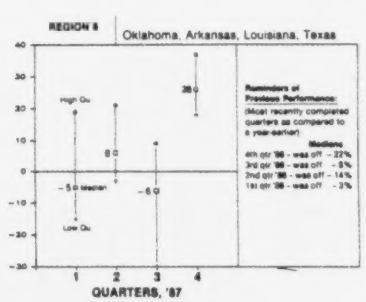












REGIONALITY was prevalent in 1986 for members of the Northamerican Heating and Airconditioning Wholesalers Association and is evident again in these regional forecasts. They depict the expectations of the upper quartile, lower quartile, and median of all reporting wholesalers in that region. Two regions are missing because not enough meaningful reports were received from them.

FROM PAGE 113

The largest median increase, 10%, was reported for firms with volumes between $5 and $7.5 million.

1987 forecast

Looking ahead, NHAW has changed its forecasting style. Instead of product groupings (air conditioning, refrigeration, controls, sheet metal), the new format provides a quarter-by-quarter comparison of total sales — nationally and by region — compared to the identical quarter in the previous year.

On a national basis, the forecast predicts that NHAW wholesalers in the U.S. and Canada will see a 3% median gain in sales for the first quarter of 1987 (the first quarter of 1986 was up 5%). The second quarter increase should be only 1% (compared to a 7% gain in the second quarter of 1986).

Median increases of only 2% are expected in the third and fourth quarters of this year (compared to respective gains of 10% and 7% in the same period of 1986).

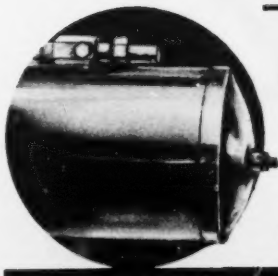
The forecast is prepared for NHAW by William Spooner and Associates, Inc. It relates sales data supplied by NHAW members with econometric models maintained by the University of California at Los Angeles (UCLA).

In fact, the consultant reported that NHAW sales experience is exceptionally closely related to two popular economic indicators — residential and nonresidential construction expenditures.

Again, there is a wide disparity between regions. The major gains in Region 3 last year are expected to slip a bit in the first half of 1987 but rebound in the second half. Continuing lackluster performance is expected for the oil-producing states (Region 8) for the first three quarters of this year but markets are expected to rebound by a whopping 26% late in 1987.

As in the national chart, it should be noted that there is a wide disparity between the upper and lower quartiles in almost all of the individual regions. Two of the regions, 1 and 9, are missing because of insufficient data.

Each Statistical Panorama includes the latest data available. Sources frequently revise their previous year's figures, which explains apparent discrepancies between the latest and earlier published data. Where sources give significantly varying information, that data is mentioned.



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Percent of dollar value potential for 1987 vs 1986

Product	Northeast	Southeast	Central	Southwest	West	Total U.S.	Canada
Unitary AC&H equipment (4 tons and under)	6.6	17.2	5.4	3.8	7.4	9.7	12.6
Unitary AC&H equipment (over 4 tons)	**5.3**	**4.9**	**3.9**	**4.2**	**7.9**	**4.8**	**14.0**
Refrigeration condensing units	1.1	7.7	5.0	6.7	4.0	5.8	8.2
Refrigeration coils	**0.6**	**9.2**	**5.0**	**6.8**	**4.9**	**6.4**	**5.5**
Replacement compressors	1.8	10.3	7.8	8.1	9.0	8.4	12.2
Refrigerant	**-6.2**	**1.2**	**5.2**	**5.5**	**2.4**	**2.5**	**3.8**
Driers, strainers, filters, and sight glasses	0.8	8.6	6.7	4.0	1.6	5.7	5.4
Refrigerant flow controls — TEV, solenoid, regulating valves, etc.	**1.8**	**5.6**	**3.9**	**4.0**	**2.1**	**4.1**	**6.3**
Pressure and temperature controls	1.8	5.6	5.2	4.1	3.8	4.6	7.9
Electrical controls — relays, contactors, and starters	**2.7**	**7.1**	**5.1**	**4.3**	**4.0**	**5.3**	**13.1**
Capacitors	1.2	8.8	4.0	4.5	2.3	5.3	5.2
Electric motors	**1.1**	**9.4**	**5.3**	**8.6**	**8.6**	**7.4**	**5.8**
Pipe and tubing fittings	4.6	8.4	2.0	1.9	3.2	4.7	12.0
Pipe and tubing insulation	**4.7**	**9.5**	**1.4**	**2.1**	**1.9**	**4.8**	**6.1**
Grilles, registers, and diffusers	-7.6	8.4	2.3	2.1	0.0	4.2	13.0
Sheet metal and fittings	**10.0**	**9.2**	**2.6**	**2.1**	**0.0**	**5.7**	**-9.8**
Air filters and air cleaners	5.8	7.9	5.0	2.5	3.6	5.4	6.6
Water treatment and maintenance chemicals	**0.7**	**7.1**	**1.6**	**2.7**	**6.6**	**4.4**	**4.7**
Instruments and test equipment	1.6	9.1	3.8	2.7	3.3	5.2	4.0
Totals	**7.8**	**11.0**	**5.5**	**5.6**	**11.0**	**8.4**	**17.0**

1987 SALES FORECAST undertaken by members of the Air-conditioning and Refrigeration Wholesalers (ARW) shows an overall gain of 8.4% in dollar volume over 1986. A total of 70 firms submitted data. The figures represent the weighted average (by sales volume) of all responses. Total sales represent the arithmetic average of all wholesaler estimates of 1987 total sales and are not an aggregate of the product categories.

REPLACEMENT MARKET

Replacements may lack the dynamism of the new construction market but there is no doubt about the stability they add to the marketplace. They are the glue that hold the individual markets together in bad times and keep increases within reason when construction takes a sudden jump.

Briefly, then, replacements are the best single antidote to the boom-and-bust characteristics of new construction.

In a year like 1986, when shipments of residential heating and cooling equipment were at or near all-time highs, replacements tended to take a back seat to the more volatile new home market. But, when the need for new construction declines sharply as in today's office building market, replacements and renovation take on a much more important role.

The percentage of replacements within the total shipment varies widely among product groups. Last year, for example, it ranged from less than 10% for electric furnaces to almost 90% for oil-fired furnaces. The rapidly maturing central air conditioning market, which for many years leaned heavily on new home construction, now depends on replacements for half its business. New construction accounted for little more than a third of annual shipments last year.

While the replacement market usually strengthens somewhat when new construction demand slackens, that's not always the case. In the early 1980's the recession and extremely high interest rates combined to force a sharp decline in both the new construction and replacement-renovation markets. There was also evidence that many homeowners postponed repairing cooling system breakdowns near the end of the season because of high interest rates on loans and employment uncertainty.

Both manufacturers and contractors have been restructuring their businesses in recent years to take advantage of the surge in cooling replacement sales. For contractors, this means paying much more attention to service — the gateway to most renovation-replacement sales — and ways to help homeowners upgrade their indoor comfort systems.

Renovation expenditures

Before taking a look at individual industry markets, it might be well to look at national total expenditures for alterations and repairs as reported by the Bureau of the Census and the Bureau of Labor Statistics. Their surveys cover 51.3 million owner-occupied housing units and 14.7 million rental properties.

Total expenditures for 1985, the latest year for which these figures are available, amounted to $80.267 billion, up 15% from the $69.784 billion total reported for the previous year.

Heating and air conditioning repairs and alterations accounted for 6.35% of that total, down from a 7.3% share in 1984. Although heating and air conditioning total expenditures of 5.096 billion in 1985 was almost the same as the $5.071 billion the previous year, it represented a 37% increase over the 1983 total of $3.714 billion.

The steep rise from 1983 to 1984 reflected repair and alteration work that had been postponed during the recession in the early 1980's. The continued strength of that market, we feel, is due in large measure to the broad-based desire to upgrade equipment for reasons of efficiency.

Of the $5.096 billion spent on heating and air conditioning systems in 1985, a total of $1.653 billion (32.4%) was spent for maintenance and repairs; $1.121 billion (22%) was spent for alterations to existing systems; and $2.322 billion (45.6%) was spent for major replacements.

More than two thirds (68.5%) of the total, or $3.492 billion, was spent in owner-occupied single-family homes and 31.5%, or $1.604 billion, was spent in rental properties.

Regionally, the share of repair-renovation expenditures for owner-occupied single-family homes broke down this way: Northeast $626 million (19.1% of the total); Midwest $1.476 billion (44.9%); South $872 million (26.5%); and West $312 million (9.5%0).

The regional breakdown shows meaningful gains among homes in the Northeast (15.4% to 19.1%) and in the Midwest (35.5% to 44.9%) and corresponding losses in the South and West when 1985 is compared to the previous year.

Significantly, 88% of all major replacements in owner-occupied single-family homes were handled by contractors, down from 95.5% in the previous year. Of the remainder, 10.8% of the replacements were handled by the homeowner and, in the case of 1.2%, the homeowner bought the materials that were later installed by a contractor.

The National Association of Home Builders (NAHB) estimated that the total volume of the residential alterations and repair market in 1986 improved by 6% to about $85 billion.

NAHB estimated that one fourth to one third of homeowners make improvements in any given year. Additions and alterations account for 70% of expenditures among owner-occupied dwellings but, among rental properties, more than half of the improvements are replacements.

Expenditures for improvements tend to be concentrated among homes that have recently changed hands. An analysis of data for the years 1978 through 1981 indicated that spending for alterations and additions averaged $840 for homes purchased within one year, $520 for homes purchased in the year previous to that, $454 for homes bought two to four years earlier, and $250 for homes in which the owners had lived for more than 10 years.

This relationship suggests that, in light of the strong sales of existing

homes in 1986, the demand for alterations and repairs this year should be exceptionally strong. The ready availability of loans at the lowest rates in many years is likely to reinforce that trend.

It might also be noted that a 1983 survey conducted by the Harvard-MIT Joint Center for Housing Studies indicated that 40% of home sellers spent an average of $1,265 to fix up their homes prior to selling them. Most of that expenditure, however, was thought to be for repairs rather than improvements.

Air conditioning

For easier understanding, the replacement market for unitary air conditioning should be separated into four parts: residential and commercial comfort cooling and residential and commercial heat pumps. For example, the unitary residential replacement share last year was 44% of shipments. But the two components of that share, comfort cooling at 50.5% and heat pumps at 22.6%, were quite different.

If we subtract 884,203 heat pumps from the 3,555,630-unit 1986 unitary total, we get 2,671,427 comfort cooling units — of which 82.4% or 2,201,256 were residential and 17.6% or 470,171 units were commercial.

This split was selected because it matched the determination of the Air-Conditioning and Refrigeration Institute (ARI) for 1985, the latest year for which this split was available. (If you're comparing this split with the one found in the "Air Conditioning" section, remember that this one does not include heat pumps.)

Of the 2,201,256 residential cooling units shipped in 1986, we estimate that 813,700 (37%) went into new construction (482,400 into single-family homes and 331,300 into multifamily units). These figures are arrived at by multiplying the known penetration rates for central air conditioning by the known number of housing starts and subtracting the known number of heat pumps.

Looking back at the revised total of 811,500 comfort cooling units we estimated were installed in new homes in 1985, we can see that this market segment remained almost flat last year at 813,700 units. But as we shall see shortly, the growth was in the heat pump segment.

The other residential cooling units break down this way: 1,112,500 (50.5%) were replacements, up from 965,200 units (47.4% in 1985); 220,000 (10%) were add-ons, up from a revised figure of 203,500 in 1985; 40,000 units (1.8%) went into new mobile homes; and 15,000 units (0.7%) were mobile home replacements.

There is evidence that the strong driving force exerted by electric utilities offering rebates based on efficiency is beginning to taper off. This contribution to the replacement market has largely compensated for two relatively cool summers in a row, a condition that tends to depress replacement sales. Utility rebates can be expected to recede slowly as they accomplish utility marketing and summer peak load shaving objectives.

It must be remembered that the central air conditioner population now exceeds 29 million units. Of these, more than a million each year cross into the

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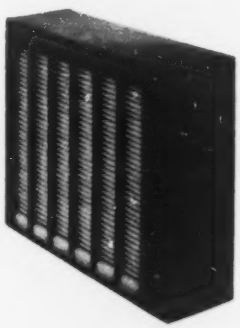

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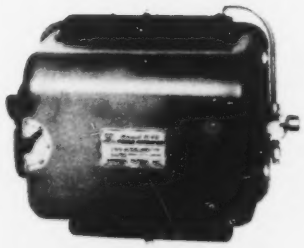

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12- to 15-year-old prime replacement category. Looking ahead, this population of prime replacements should come close to 2 million units a year by the end of the decade — a development that should help push unitary shipments over the 4 million mark despite a relatively flat housing market.

In the nearer term, an increase in replacement cooling units of only 10% this year could more than offset the expected drop in multifamily housing. A long, hot summer could produce even better results.

Commercial

Of the estimated 470,171 commercial unitary comfort cooling units shipped last year, we estimate that about 65% went into new construction and 35% were replacement units. The total represented an 8.2% increase from the revised total of 434,700 commercial cooling units shipped in 1985.

About half of the commercial replacements go into the South, 25% into the Midwest, and the remainder are equally divided between the Northeast and West, according to a study made by Kenneth E. Hickman, vice president, research and advanced engineering, York International Corp.

In addition to the installed value of commercial unitary air conditioners covered in the "Air Conditioning" section, The News has come upon reliable total tonnage figures for this category developed by ARI.

The institute reported that 3,509,111 tons of unitary commercial air conditioning was installed in 1985, the latest year for which these figures are available. This represents a 4.5% decline from the 3,673,829 tons installed in 1984.

However, it should be remembered that the 1984 figure was 40.6% higher than in 1983. In fact, not since 1973 has the commercial tonnage total rivaled 1984-1985 performance. When the totals for 1986 are developed it is probable they will more than gain back the previous year's loss and set a new tonnage record.

Heat pumps

In the case of the 751,600 residential heat pumps we estimate were shipped last year (85% of total shipments amounting to 884,203 units), it would appear that 561,500 (74.7%) went into new homes. Of these, we estimate that 342,000 went into new single-family homes and 219,500 heat pumps went into multifamily dwellings.

This represents a 7.8% increase over the revised total of 697,500 residential heat pumps we estimate were shipped in 1985. It reflected continuing strength in the multifamily market, which includes condominiums and cooperative apartments. This strength already is eroding and, in 1987, this factor and continuing doldrums in the South will reflect a slight decline in heat pump shipments.

Of the remaining residential heat pumps, we estimate that 15,000 were add-on units (including fossil fuel-fired furnaces), 5,000 went into mobile or manufactured homes, and 170,000 (22.6%) were replacements. The replacements increased by 14.4% in numbers over the 1985 total of 148,600 units but, as a percentage of residen-

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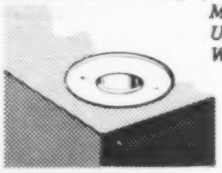

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Mr. Warren Steelman, President
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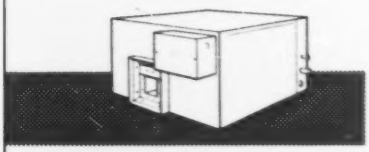

Comfort

"Our customers tell us about the improved comfort produced by the UNI-PAK central air conditioning system. With up to 30% more humidity removal by the UNI-PAK air handler, we understand why."

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tial shipments, the increase was only 1.3%.

In terms of commercial heat pumps, we think 119,300 units, or 90% of the 132,600-unit total, went into new installations and only 10%, or 13,800 units, were replacements. The total represents a 7.8% increase over the 123,000 commercial heat pumps we estimate were shipped in 1985.

These figures are in reasonable agreement with this developed for the "Air Conditioning" section to indicate the commercial rooftop market. It must be noted, however, that both sets of figures depend upon arbitrary judgments.

The add-on market for residential comfort cooling, fed by the desire of homeowners for the comfort of central air conditioning without the need to buy another home, once led replacements by a wide margin. But, as the market has matured, the number of add-on units keeps diminishing.

For example, as late as 1981, add-ons had an estimated 29% market share. We believe that share has slipped from about 12% to 10% over the last three years and, in 1986, amounted to 220,100 cooling-only units and about 15,000 add-on heat pumps. It should also be remembered that this percentage also gets pushed down because the total market has grown. The total number of add-on units has not declined nearly that rapidly.

In years when new home construction is down, the number of add-ons tends to be higher than in years, such as the last four, when the new home construction market is up. However we feel that this market, though small in comparison to new construction and replacements, has reached a minimum that will characterize it for several years to come.

A small but significant added driving force for the add-on market has been the trend to replace old furnaces for the sake of efficiency. We suspect that many homeowners who did not have central cooling elected to add it when they replaced their aging heating plant.

Boilers

Of the 333,002 residential boilers shipped in 1986, we estimate that only 74,300 went into new single-family homes. When about 6,000 boilers for new multifamily homes are added, the total comes to 80,300 boilers, or 24.1% of shipments. The other 252,700 units, or 75.9% of shipments, were replacements.

Small as it may be, the percentage of boilers that went into new homes last year represents a 54.1% increase over the estimated 52,100 boilers that went into new homes the previous year. The reason is twofold. Not only has new home construction remained strong in the Northeast but oil prices have tumbled in the last year to make this fuel choice — a popular one in the Northeast — affordable again.

In passing, it might be noted that the gas conversion phenomenon, which distorted residential gas boiler shipments at the turn of the decade, is long over. Today's market is on a more normal footing and oil-fired units have regained much of the ground they lost in the conversion war.

Furnaces

Of the 200,540 residential oil-fired furnaces shipped last year, we estimate that 20,250 (10.1%) went into new single- and multifamily homes. This means 180,290 residential oil furnaces, or 89.9% of shipments, were replacements.

Again, the 66% increase in oil furnaces going into new construction in 1986 compared to the year-previous total of 12,200 units is impressive in terms of percentage but the numbers are relatively small. The shift is explained by the sudden drop in oil prices in late 1985 and the relatively high cost of both gas an electricity in oil's major market, the Northeast.

Not to be forgotten, either, should be the 214,000 replacement oil burners shipped in 1986, according to Fuel Oil/Oil Heat magazine. The publication's editors reported that virtually all of these are retention-head or other high-efficiency types. In fact, it has become increasingly difficult to find standard-efficiency burners anymore.

Of the 2,104,805 residential gas furnaces shipped in 1986, we estimate that 706,200 (33.6%) went into new single- and multifamily homes; 102,200 (4.9%) went into new mobile or manufactured homes; 35,000 (1.7%) were net conversions from other fuels; and 1,261,400 gas furnaces (59.9%) were replacements.

The 1986 experience compares to 633,000 gas furnaces into new construction (34.7% of the total) in 1985 and 1,030,400 gas furnace replacements (56.5% of the total).

Efficiency

Actions by homeowners anxious to control their fuel bills have resulted in the development of a whole new market within the past five years — a market that involves the replacement of inefficient equipment in good working order the sake of efficiency.

For example, the inefficient (below 65% annual fuel utilization efficiency or AFUE) atmospheric gas furnaces that represented almost the whole market six years ago had shrunk to a 13.5% market share in 1986 (See "Comfort in Construction").

At the other end of the spectrum, 650,550 gas furnaces shipped in 1986, or 30.9% of the total, had AFUE's of 80% or better. Most of these were replacements.

Similarly, the Gas Appliance Manufacturers Association (GAMA) also reported that 52.4% of the oil-fired furnaces shipped in 1986, or 105,035 units, had AFUE's of 80% or more. In fact, only 6.1% of the total, or 12,170 units, had AFUE's below 75%.

This efficiency market, while encouraging, appears to have stabilized. Over the past three years the high-efficiency market for gas-fired furnaces has stayed at about 30% of the total. It's interesting to note that the high end of that market (86% and over) has increased steadily from 11.1% in 1984 to 12.3% in 1985 and 15.8% last year. The gains, however, have almost all been at the expense of equipment in the 80% to 86% range.

Not only has fuel oil dropped in price dramatically, but gas and electricity have stopped escalating at the steep rates of the past. All have shown signs that future increases will probably be modest for at least the next five years. When that realization is fully absorbed by the public, we suspect it will be difficult to sustain the efficiency market at today's high levels.

This is not the case, however, for comfort cooling and heat pumps. Electric rates already are high and, while they are not expected to escalate rapidly in the near future, they continue to attract attention from homeowners. This is particularly true in the South where many utilities have imposed seasonal and time-of-day penalties in order to reduce peak load requirements.

Homeowners have reacted in two ways — by buying more efficient air conditioners and heat pumps and by using them less. This market is expected to continue even after many of the utilities gradually withdraw their efficiency incentive programs.

FUELS AND ENERGY

United States energy consumption for the first three quarters of 1986 was 55.17 quadrillion Btu (quads), down 0.08% from the 55.213 quads consumed in the same period of 1985.

The total was also down 6.17% from the 58.8 quads consumed during the first three quarters of 1979, the peak year for energy consumption since the Arab oil embargo of 1973. The total energy consumed in the U.S. in 1985, the last year for which 12-month data is available, was 73.938 quads, or 0.5% less than the 74.282 quads consumed in 1973.

The Department of Energy's Energy Information Administration (EIA), which reports these data, continues to run later and later. We can no longer report full prior year data, or even 11-month figures. In this year's report we must be content with figures for three quarters of 1986.

In the residential-commercial sector (EIA lumps them together) the 20.332 quads consumed during the first three quarters of 1986 was 1.35% more than the 20.062 quads consumed by this sector in the same period of 1985. The 1985 full-year total of 26.819 quads represents an 11.09% increase over the 24.142 quads used by the residential-commercial sector in 1973.

During the first three quarters of 1986, this sector represented a 36.85% share of total energy consumption — up a hair from the 33.34% share for the same period in 1985, and up considerably from the 32.5% share for this sector in 1973.

Industrial sector consumption of 19.483 quads for the first three quarters of 1986 was down 3.76% from the 20.21-quad total for this sector in the same period a year earlier. The 1985 full-year total of 27.012 quads for the industrial sector was 14.36% lower than the 31.537 quads it consumed in 1973.

During the first three quarters of 1986, the industrial sector represented a 35.31% share of total energy consumption, down from a 36.6% share during the same period a year earlier. In 1973, the industrial sector consumed 42.46% of the nation's energy.

For the record, the tranportation sector consumed 15.353 quads during the first three quarters of 1986, up 2.68% from the 14.95 quads consumed by this sector during the same period in 1985. It represented a 27.08% share of total energy consumption for the 1986 period. The share in 1973 was 25.03%.

Electric utilities consumed 20.109 quads of energy during the first three quarters of 1986, up 0.8% from the 19.951 quads consumed in the same year-previous period. The 1985 full-year total of 26.454 quads was 33.26% higher than the 19.852 quads consumed by electric utilities in 1973.

Of the 20.332 quads consumed by the residential-commercial sector during the first three quarters of 1986 (with the share for the same period a year earlier in parentheses), only 0.63% (0.61%) was coal; 25.29% (26.16%) was

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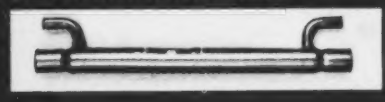

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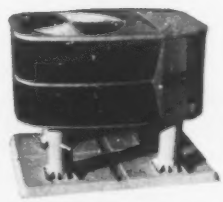

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FUELS

natural gas; 9.09% (9.27%) was petroleum; 19.83% (19.14%) was electricity; and 45.16% (44.8%) was electrical system generation and transmission loss.

Similarly, the 19.483 quads used by the industrial sector in the first three quarters of 1986, (with the share for the same period in 1985 in parentheses), broke down this way: 10.56% (10.17%) coal; 25.05% (26.07%) natural gas; 29.08% (28.58%) petroleum; 0.13% (0.13%) hydroelectric power; 10.77% (10.5%) electricity; and 24.47% (24.35%) electricity generation and transmission losses.

Conservation

In order to get a gross measure of conservation, DOE records show that, in 1973, it took 27,100 Btu to generate each 1982 constant dollar of GNP (gross national product). In the third quarter of 1986, it took only 20,000 Btu to generate a constant dollar of GNP, or 26.2% less than in 1973. The 1986 figure also is down 1.5% from the 20,300 Btu it took to generate a constant dollar of GNP in the third quarter of 1985.

In simple terms, it means that the U.S. economy in the third quarter of 1986 produced at the rate of 3.687 trillion constant 1982 dollars worth of goods and services with 26.2% greater energy efficiency than in 1973. Had it not been for this improvement in efficiency over the 13-year period, U.S. energy consumption would have been at a rate of 93.007 quads in the third quarter of 1985 instead of the actual 73.698 quads.

Fuel costs

The average price of No. 2 fuel oil for U.S. homes in November, 1986, was 73.3 cents/gal, down a whopping 34.5% from the average of $1.119/gal in November, 1985. It also represents a 38.6% drop from the $1.194/gal paid in November, 1981. The residential cost of No. 2 fuel oil in 1978, just before the second oil price shock, was 49 cents/gal.

In November, 1986, the price of No. 2 fuel oil to homes ranged from 87.4 cents/gal in Detroit and 81.5 cents/gal in Chicago to 64.9 cents/gal in Portland, Ore., and 65.1 cents/gal in Pittsburgh according to EIA figures.

Average residential natural gas prices in November, 1986, declined by 6.7% to $5.53/1,000 cu ft from $5.93/1,000 cu ft in the same month a year earlier. This follows a 2.6% drop from

November, 1984, to November, 1985.

It should be remembered, however, that the November, 1986, average price still was 50% higher than the $3.68/1,000 cu ft charged in 1980 and 328% higher than the $1.29/1,000 cu ft average in 1973.

In the case of specific cities, EIA reported that, in November, 1986, the price of natural gas expressed in dollars per 1,000 cu ft ranged from $8.06 in New York and New Jersey and $7.75 in Washington, D.C., to $3.42 in Anchorage, Alaska, and $3.45 in Houston. Utility gas in Honolulu, Hawaii, where the only gas available is synthetic or LNG (liquefied natural gas), costs $15.49/1,000 cu ft.

The average price charged residential customers by privately owned electric utilities in November, 1986, was 7.3 cents/kWh, down 5.56% from the 7.73 cents/kWh average for the same month a year earlier. In the period from November, 1984, to November, 1985, the average price of electricity for residential customers increased 1.4%.

The 1986 average price, however, was 69.4% higher than the 4.31 cents/kWh charged in 1978 and 187% higher than the 2.54 cents/kWh charged in 1973.

The average price electric utilities charged commercial customers in September, 1986 (the latest date for which these figures are available), was 7.57 cents/kWh, down 0.65% from the 7.62 cents/kWh charged in the same month a year earlier. The 1986 price represented a 73.6% increase over the 4.36 cents/kWh charged in 1978 and a 214% increase over the 2.41 cents/kWh charged in 1973.

Similarly, the average price electric utilities charged industrial customers in September, 1986, was 5.2 cents/kWh, down 0.8% from the 5.24 cents/kWh charged in the same month of 1985. The 1986 price represents an 86.4% increase over the 2.79 cents/kWh charged in 1978 and a 316% increase over the 1.25 cents/kWh charged in 1973.

Total industry electricity output for the 52 weeks ended Dec. 27, 1986, was 2,544,688 million kWh, an increase of 1.7% from the 2,501,844 million kWh output for the same period a year earlier, according to the Edison Electric Institute (EEI).

The increases in the past three years reflect the slow but steady expansion of the economy. The statistics also reflect the highly regional nature of the

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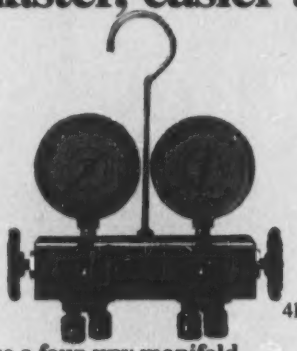

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the expansion.

For example, the Southeast (at 4.2%), Mid-Atlantic (3.5%), and New England (3.2%) were the big gainers. Output in the Pacific Northwest declined by 3.5% while the South Central (-0.6%) and Rocky Mountain states (-0.3%) didn't quite manage to stay even. A year earlier, increases were registered in all regions.

EEI reported that total electric power generation for the last quarter of 1985 and the first three quarters of 1986 amounted to 2,488,353,845 million kWh, an increase of 1.8% from the 2,444,682,662 million kWh for the same period a year earlier.

The institute reported that, for the third quarter of 1985 and the first three quarters of 1986, 56.2% of electric power was generated from coal (up 0.8%); 5.2% was generated from oil (up 30.6%); 10.4% was generated from natural gas (down 12.4%); 16% was generated by nuclear reactors (up 8.1%); 11.6% was hydroelectric power (up 2.7%); and 0.5% came from other sources (up 15.2%).

It should be noted that, in the same 1985-1986 period, electric utilities had a net import total of 35,464,708 million kWh, down 14.1% from 41,281,922 million kWh for the same period a year earlier. Similarly, purchases from industry, at 37,426,194 million kWh last year, increased by 62.7% from the year-previous total of 23,006,700 million kWh.

Electricity sales to ultimate customers for the last quarter of 1985 and the first three quarters of 1986 totaled 2,346,495,240 million kWh, up 2% from the 2,300,922,752 million kWh sold during the same period a year earlier.

Of that total, residential sales amounted to 815,237,368 million kWh, up 3.2% from the year-previous total of 789,938,419 million kWh; commercial sales amounted to 627,432,565 million kWh, up 4.7% from 599,404,119 million kWh a year earlier; and industrial sales totaled 815,708,708 million kWh, down 1.1% from 824,659,710 million kWh.

The installed nameplate capacity of U.S. electric generating plants on Sept. 30, 1986, was 673,838 megawatts (MW), down 1.9% from the 687,208 MW capacity at the same time a year earlier. Of this, 65.7% was steam, 12.7% was nuclear; 13% was hydro; 8.4% was gas turbine; 0.24% was geothermal; 0.001% (7 MW) was wind; and 0.002% (12 MW) was solar.

EEI reported that, at the end of the third quarter of 1986, the average number of electric utility customers totaled 102,142,786 — up 2% from the 100,114,822 total at the same time a year earlier.

Nuclear

In September, 1986, U.S. nuclear generating units produced a total of 36.6 billion net kWh of electricity while achieving an average capacity factor of 60.4%. It represents an increase of 6% over the previous September. Nuclear supplied 17.7% of the electricity generated in September, 1986, the highest monthly share in history.

Nuclear generation during the first three quarters of 1986, at 303,450 million net kWh, was up 5.17% from the total of 288,538 million net kWh generated by nuclear plants during the same period a year earlier. The average monthly nuclear share of all electricity generated for the first three quarters of 1986 was 16.1%, up from 15.5% for the same period in 1985.

As of Sept. 30, 1986, there were 99 operable U.S. nuclear power generating units with a collective net summer capability of 84.1 million net kW. These are included among the 128 domestic nuclear generating units in all stages of planning, construction, or operation. They have an aggregate design capacity of 119 million net kW.

It's significant to note that no new nuclear power plants have been announced since 1978 and that, since then, plans for dozens of plants have been cancelled.

Natural Gas

Gas utility thermal equivalent sales were down 14.2% in 1986, according to preliminary figures released by the American Gas Association (AGA). The total for 1986 was 10,823 trillion Btu equivalent, down from the 12,615 trillion Btu equivalent in 1985.

Industrial sales, which represented 25.7% of the total, were 2,785.5 trillion Btu, down 24.4% from 3,686.2 trillion Btu in 1985. Sales for electricity generation (11.3% of the total) were 1,225.6 trillion Btu, down 37.1% from 1,948.7 trillion Btu in the previous year.

Residential sales (41% of the total) were 4,433.5 trillion Btu, down 1.8% from 4,513 trillion Btu in 1985. Commercial sales (20.8% of the total) were 2,254.8 trillion Btu, down 3.6% from 2,338.1 trillion Btu in 1985. The "other" category (1.1% of the total) was 123.6 trillion Btu, down 4.6% from the year-previous figure of 129.5 trillion Btu.

AGA reported that average natural gas utility prices, expressed in dollars/million Btu, in December, 1986, were: all $4.62; residential $5.20; commercial $4.79; industrial $3.69; electric generation $2.57; and industrial and electric generation grouped together $3.34.

What's ahead

Looking toward the future of energy supplies and prices, there are so many variables that it's possible to build a logical case for a myriad of scenarios. If we restrict our vision to the U.S. and to the impact of the U.S. dollar — the medium of exchange for foreign oil and gas — the exercise becomes a bit more

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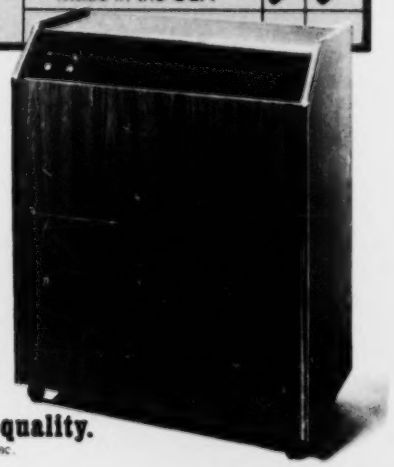

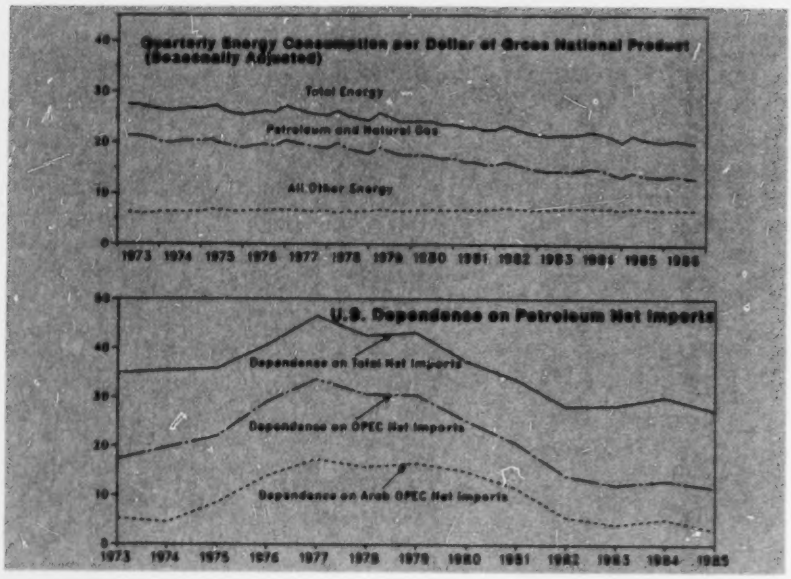
Quarterly Energy Consumption per Dollar of Gross National Product (Seasonally Adjusted)
Total Energy
Petroleum and Natural Gas
All Other Energy
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986
U.S. Dependence on Petroleum Net Imports
Dependence on Total Net Imports
Dependence on OPEC Net Imports
Dependence on Arab OPEC Net Imports
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985

rational.

In the United States the questions boil down to the supply of domestic natural gas and the impact of world oil prices on the domestic oil market. The other three principal energy sources — coal, nuclear, and hydro — are essentially national resources wholly within the nation's control.

The dramatic drop in world oil prices that began in late 1985 has further complicated problems for the U.S. natural gas industry. The industry had been trying to work its way out of a substantial oversupply problem in the face of falling industrial and electric utility demand since 1983.

Despite a decline in natural gas consumption in 1986 (6.4%) and a further decline expected this year, the Gas Research Institute (GRI) is confident the industry will overcome its unprecedented slump in drilling activity and make an orderly transition from the current gas "bubble" to a balanced supply situation early in the 1990's. "Over the longer term, abundant, feasible supply options exist to support a strong, competitive industry well into the next century."

Industry

Industrial and electric utility consumption of natural gas accounts for half of total consumption. The combination of a declining manufacturing

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sector, depressed economies in areas where gas use is particularly heavy, and strong price competition from residual fuel oil is likely to prevent industrial gas usage from improving in the near term, GRI believes. (Industrial gas consumption declined by 8% during the first nine months of 1986.)

GRI expects industrial gas consumption will recover to 1985 levels by 1989. Over the longer term, this market is expected to grow at a modest pace of 1.5% per year through 2010. However, the gas share of industrial energy consumption is projected to gradually decline as a result of increased price competition from residual fuel oil in the near term, and increased penetration by electricity and coal in the longer term.

Utilities

In 1986 and 1987, electric utility demand for natural gas is expected to fall sharply. The decline in the first nine months of 1986 was 14%. The decline is attributable to the completion of the current electric utility building cycle, relatively little increase in the demand for electricity, and strong price competition from residual fuel oil. Of the new generating capacity added in 1985, more than 90% was coal- or nuclear-fired.

GRI expects that new gas-fired electric generating facilities, because of their short construction lead times, will be added to meet new electric demand peaks in the late 1990's. Following that spurt, however, utility gas demand will flatten as electric utilities adjust to growth by adding new coal-fired plants.

Commercial

Although commercial gas consumption growth rates will remain low through the 1990's as a result of overbuilding, GRI expects the growth rate over the next 15 years will exceed the growth rate of the gross national product (GNP). The overall growth rate through the year 2010 is expected to be 1.5% per year.

The major commercial growth market for natural gas, GRI contends, will be cogeneration. By the turn of the century, the institute believes 19% of commercial sector gas will be used for cogeneration. But to develop the large potential in smaller applications, competitive off-the-shelf equipment will have to replace today's site-specific engineered systems, GRI warned.

TURN TO NEXT PAGE

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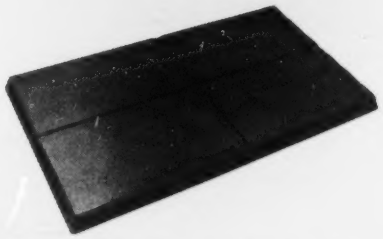

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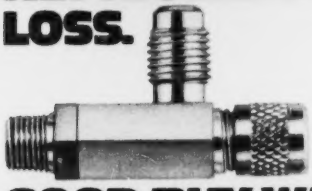

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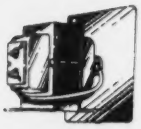

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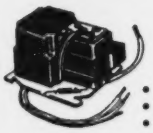

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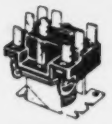

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Circle 25

FUELS

Residential

The essentially flat (0.5% per year) growth in residential gas energy demand expected for the next quarter century, or half the rate of growth of housing, reflects an expected continuation of energy conservation in both construction practices and equipment. This slow growth will not be reflected by the projected increase in gas-heated homes from 45 million today to 55 million by the year 2010.

A major impediment to growth is the gas pipeline and distribution system infrastructure. Some of the regions in which housing is expected to grow most rapidly, such as the South Atlantic states, are those in which the distribution system is most limited.

Oil

The world price of oil, the hinge upon which many other competitive fuels turn, reached its peak in 1981 at $37.05/barrel. In 1985 it had stabilized at about $28/barrel but, late that year, began a precipitous drop that took it to $10.91/barrel in mid-1986. By October of last year the U.S. refiner acquisition cost of crude (from both domestic and foreign sources) was $13.05/barrel.

In early 1987 the Organization of Petroleum Exporting Countries (OPEC), after repeated failures, put together a cartel floor price of $18/barrel. However, after less than two months, there are signs that this latest price-fixing effort — propped up by the extraordinary demands of Europe's severe winter — will again fail. Look for world oil prices to return to about $15/barrel in the near term.

Most forecasters agree that world demand is unlikely to increase at more than 1% per year through 1995. GRI expects it will take that long for the world oil price to reach $20/ barrel (in 1985 dollars) and the year 2000 before 1985's $28/barrel is realized. It should be noted that OPEC tends to increase prices when world production approaches 80% of capacity.

U.S. demand for oil, which declined during the past decade as the economy became more efficient and switched to other fuels, will probably increase during the next decade. EIA expects the increase to be 0.5% per year; GRI puts the increase at 1.1% per year.

Either way, the increase comes at a time when U.S. production in both Alaska and the lower 48 states has reached its peak in terms of current

economics. Domestic production is expected to decline by about 3% per year over the next decade.

This means that the shortfall will have to be met by imports. GRI predicts that, by 1995, U.S. imports will exceed the 1977 historical peak of 8.6 million barrels/day. Five years later, more than half of U.S. oil requirements will be imported, much of it from Mideast OPEC nations.

Evidence of this trend was apparent in 1986. Average U.S. domestic oil production for the first 11 months of last year, at 10.662 million barrels/day, was 1.24% less than the 10.796 million barrels/day average for all of 1985.

Importantly, the average of 5.992 million barrels/day of imported oil for the first 10 months of 1986 was 18.25% higher than the average imports of 5.067 million barrels/day for all of 1985. Half of the increase came from Saudi Arabia alone. Again, 49.6% of U.S. oil imports last year came from OPEC nations.

Exploration

Total exploration and development well completions in the first 11 months of 1986 amounted to 36,570, a 43.2% decline from the 64,340 well completions in the same period a year earlier. Even though one month had not been reported, the total for 1986 will be dramatically lower than the 90,130 wells completed in the peak year of 1981.

Oil well completions during the first 11 months of 1986 totaled 17,350, down 46.1% from the 32,210 oil wells completed during the same period in 1985. The 7,600 gas wells completed during the first first 11 months of 1986 represented a 43.3% decline from the 13,410 gas wells completed in the same period a year earlier. The remainder represent dry wells.

Total footage drilled in the first 11

Our unofficial estimates of unitary market shares

When it comes to figuring the shares of the unitary air conditioning market held by individual manufacturers, we must depend on "feel" rather than reliable numbers. There are no reliable numbers.

Each year, too, the percentages shift as companies enter or leave the market, as one company is acquired by another, or distribution-product-promotion improvements are reflected in the marketplace.

In the past year alone The News reported more than 80 mergers, acquisitions, or spin-offs involving almost twice that number of companies directly involved in this industry. What's more, we're not confident that even that list is complete.

It must be remembered, too, that like all national figures our estimates of market share will seldom provide an accurate picture of what is happening in any specific city or area of the country. Some of the essentially regional manufacturers, with a small national share of market, often are among the leaders in the areas where their distribution is concentrated.

Another distortion comes from the interest of the reader. Whether a particular manufacturer is strong in new construction, add-on, or replacement sales makes little difference to many. But for a contractor that specializes, the list of competitive brands can expand or contract according to his interests — and change when his emphasis changes.

Because of these and other situations within their own cities, contractors often get a distorted view of national market shares.

For them, and for market researchers not deeply involved with the air conditioning industry, The News offers these educated guesses of unitary equipment market share in terms of units shipped:

Carrier (including Bryant, Day & Night, and Payne) — 23%.

Rheem-Ruud — 15%.

Trane — 13%.

Lennox — 12%.

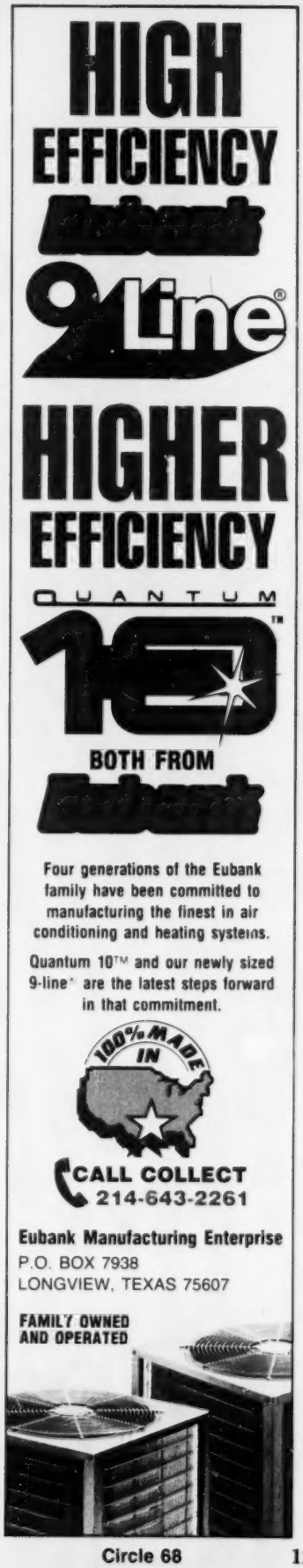
Heil-Quaker — 7%.

Central Environmental Systems of York International — 7%.

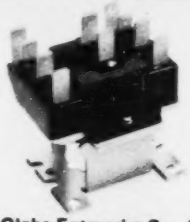
SnyderGeneral (including Arcoaire and Comfortmaker) — 8%.

Magic Chef (including Johnson, Air Ease, Williams, Armstrong, Gaffers and Sattler) — 2%.

Heat Controller — 2%.



GENERAL PURPOSE SWITCHING RELAYS



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months of 1986 amounted to 162.59 million feet, or 43% less than the 285.11 million feet drilled during the same period in 1985. In the peak year, 1981, a total of 409.13 million feet were drilled.

In December, 1986, the 963 rotary rig count was 50.6% less than the 1,950 rigs operating in December, 1985. The 89 rigs operating offshore last December represented a 53.2% drop from the number of offshore rigs operating a year earlier.

Rotary rig activity averaged 964 during 1986, a 51.3% decline from such activity in 1985. The decline was evenly split between land-based and offshore rigs. In 1981, rotary rig activity averaged a record 3,970.

In November, 1986, a total of 158 crews were engaged in seismic exploration for oil and natural gas, down 54.3% from the 346 crews operating in November, 1985. The 19 marine vessels operating in November, 1986, were down from 41 vessels a year earlier; the 139 land crews were 54.4% fewer than the 305 crews working at the same time a year earlier.

Coal

Despite small declines in the past two years, the U.S. coal industry should set a production record in 1987, according to the National Coal Association (NCA).

Coal production in 1986 was estimated at 884 million tons, down a marginal 0.2% from the 886 million tons produced a year earlier. The 1985 total was 1.1% lower than the 896 tons produced in 1984.

"Although 1987 coal consumption is expected to increase by only 0.7%, production is expected to increase by 3.4%," said James E. Barnes, chairman and chief executive officer, MAPCO Inc., Tulsa, Okla., and chairman of NCA's Economics Committee.

The projected increase reflects an end to the large stock drawdowns by coal consumers over the past two years, he explained, and the building of stockpiles in advance of the 1988 labor negotiations. Production is expected to reach 914 million tons in 1987.

Coal consumption, at 898 million tons last year, declined 1.3% from the 910 million tons consumed in 1985. Consumption this year is expected to increase by 0.7% to 904 million tons. The stock drawdown amounted to 26 million tons in 1985 and 11 million tons last year. In 1987, coal consumers are expected to add 10 million tons to inventory.

Because industrial production is expected to increase by only 1.5% in 1987, and electricity generation by 1.8%, mixed performance is expected from coal's principal markets.

Electric utility coal consumption, which dropped 0.4% from 694 million tons in 1985 to 691 million tons last year, is expected to increase marginally (1.3%) to 700 million tons in 1987.

The slightly smaller share of the utility market for coal (55.7% in 1987 versus 56% last year) reflects an expectation of 9.9 gigawatts of new nuclear capacity coming on line this year and only 2.7 gigawatts of new coal-fired capacity. Nuclear is expected to have a pronounced effect on eastern coal markets, which will absorb 8.6 gigawatts of nuclear capacity.

Metallurgical, or coking, coal consumption, at 39 million tons in 1986, was 4.9% less than the 41 million tons consumed in the previous year. Raw steel capacity utilization in 1987 is expected to remain at the same 65% level as in the past two years.

This production rate, together with greater electric furnace use, steel imports, and the continuing penetration of continuous casting, will result in the production of 85 million tons of raw steel — but it will only require 38 million tons of metallurgical coal, down 2.6% from 1986.

Industrial coal consumption, which declined 1.2% from 83 million tons in 1985 to 82 million tons last year, is expected to climb back to the 1985 level this year. Much of the increase will come from the Great Plains coal gasification plant, which is expected to operate at its full 6 million tons/year capacity in 1987.

Coal exports, at 86 million tons in 1986, were down 6.5% from the 92 million tons exported a year earlier. The decrease reflected a 12.5% drop in Canadian exports and a 5.2% drop in exports to other nations.

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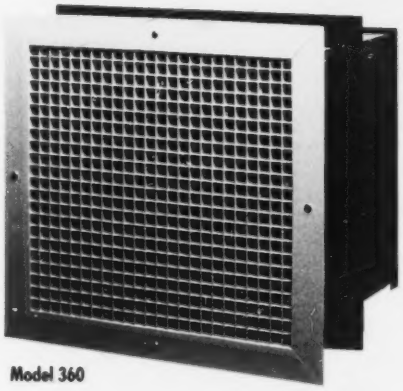

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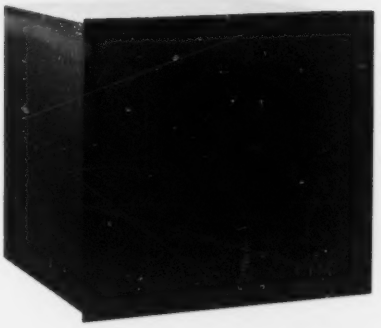

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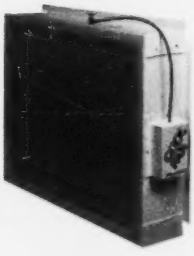

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